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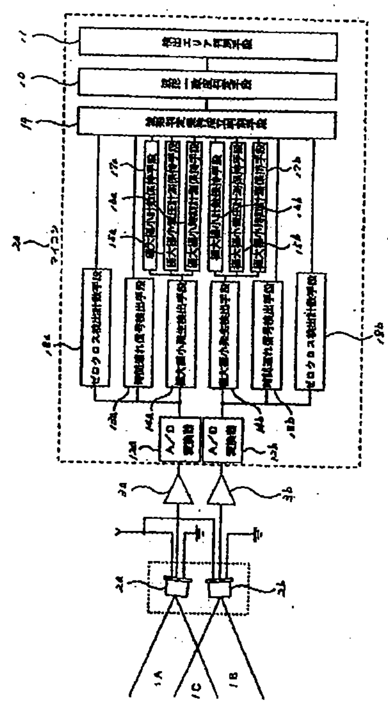
(54)【発明の名称】　物体検出装置

(57)【要約】　　(修正有)

【目的】　物体の位置を精度良く、正確に判定する信頼性の高い物体検出装置を得る。

【構成】　各赤外線検出器２ａ、２ｂが人体から放射される赤外線を互いの一部が重複する各検出エリア１Ａ、１Ｂ、１Ｃからそれぞれ検出し、この検出結果と波形判定基準とを比較し、この比較結果より各出力波形の極大・極小を極大極小検出手段１４ａ、１４ｂが確定し、また、ゼロクロス検出手段１８ａ，１８ｂが検出した各ゼロクロスを判別手段１９が判別し、判別条件が成立したときは、成立したゼロクロス区間での各出力波形の極大・極小数および同期極性と予め設定された極大・極小数および同期極の波形間判定基準とを波形一致度判定手段１０が比較し、この比較結果より検出エリア判別手段１１が各検出エリアの人体有無を判定する。



【特許請求の範囲】

【請求項１】　一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにおいて、前記各赤外線検出器の出力波形の極大・極小の発生時刻を検出し、かつ確定する極大極小検出手段と、この確定した各出力波形の極大・極小の発生時刻の時間差から各出力波形の一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたことを特徴とする物体検出装置。

【請求項２】　一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにおいて、前記各赤外線検出器の出力波形の極大・極小を検出し、かつ確定する極大極小検出手段と、前記各出力波形の電圧が基準電圧とそれぞれにクロスするそれぞれの各ゼロクロスを検出するゼロクロス検出手段と、この検出した各ゼロクロスが前記各出力波形のどちらか一方で２回発生してゼロクロス間が成立したかどうかを判別する波形成立判別手段と、この波形成立判別手段の判別結果より、判別条件が成立したときは、この成立したゼロクロス間での前記各出力波形の極大・極小の符号差から各出力波形の一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたことを特徴とする物体検出装置。

【請求項３】　一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにおいて、前記各赤外線検出器の出力波形の極大・極小を検出し、かつ確定する極大極小検出手段と、前記各出力波形の電圧が基準電圧とそれぞれにクロスするそれぞれの各ゼロクロスを検出するゼロクロス検出手段と、この検出した各ゼロクロスが前記各出力波形のそれぞれで２回発生してゼロクロス間が互いに成立したかどうかを判別する波形成立判別手段と、この波形成立判別手段の判別結果より、判別条件が成立したときは、この互いに成立したそれぞれのゼロクロス間を包括するゼロクロス区間での前記各出力波形の極大・極小数および同期極性の差と予め設定された極大・極小数および同期極性の波形間判定基準との一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたことを特徴とする人体検出装置。

【請求項４】　前記極大極小検出手段に、前記各赤外線検出器の出力波形の電圧値が予め設定された飽和しきい値幅を越えたとき、この越えた電圧値をピークカットして前記飽和しきい値幅以内に保持する飽和電圧保持手段と、この飽和電圧保持手段が保持を開始してから終了するまでの中間時間で前記各出力波形に極大・極小が発生したと判断する飽和ピーク判断手段と、を備えたことを特徴とする請求項１から請求項３のいずれかに記載の物体検出装置。

【請求項５】　前記極大極小検出手段に、前記各赤外線検出器の出力波形の電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間を越えたときは、前記各出力波形が終了したと判断し、前記出力電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間以内のときは、前記各出力波形が継続していると判断する時間遅れ検出手段と、を備えたことを特徴とする請求項１から請求項４のいずれかに記載の物体検出装置。

【請求項６】　波形一致度判定手段が、各赤外線検出器の出力波形間のピーク時間差および振幅比から設定したファジールールとメンバーシップ関数に基づいて各出力波形の一致度を判定することを特徴とする請求項１から請求項５のいずれかに記載の物体検出装置。

【請求項７】　波形一致度判定手段が、前記判別条件が成立し、この成立したゼロクロス区間での前記各出力波形の極大極小数および同期極性が同一の時に、このゼロクロス区間の前記各出力波形の最後の極大極小数および同期極性に基づいて各出力波形の一致度を判定することを特徴とする請求項３記載の物体検出装置。

【請求項８】　波形成立判別手段が、前記ゼロクロス検出手段が検出した各出力波形の終了ゼロクロスを回避して判別することを特徴とする請求項２、または請求項３記載の物体検出装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、例えば、人体のような熱源物体が放射する赤外線を検出して検出エリア内における物体の有無を検出するようにした物体検出装置に関するものである。

【０００２】

【従来の技術】図１３および図１４は、例えば、特開平２－１３４５９３号公報に示された従来の人体等の検出装置を示す図で、図１３は人体検出装置の構成を示すブロック図、図１４は、その動作を示すタイムチャートである。

【０００３】図において、１Ａ～１Ｃは赤外線の検出エリア、２ａおよび２ｂは検出エリア１Ａ～１Ｃから赤外線を検出する赤外線検出器、なお、検出エリアのうち１Ｃは、赤外線検出器２ａと２ｂが重複して検出する検出エリアである。また、３ａおよび３ｂは赤外線検出器の出力信号を増幅する増幅手段、７１ａおよび７１ｂは増幅された信号を基準と比較して２値化する比較器、７２ａ～７２ｃは比較器７１ａおよび７１ｂの信号組み合わせから、どの検出エリア１Ａ～１Ｃで人体の移動があったかを判別して出力するアンド回路である。

【０００４】従来の人体検出装置は上記のように構成され、例えば、検出エリア１Ａのみで人体等の熱源の移動があった場合、検出エリア１Ａからの赤外線変化が赤外線検出器２ａのみに限定されて集光され、赤外線検出器２ａの出力信号が変動する。この出力信号は増幅され、比較器７１ａにより２値化され、移動を示すＨ信号となる。他方、検出エリア１Ｂ，１Ｃでは赤外線の変化がないので、赤外線検出器２ｂの出力は変化せず、比較器７１ｂは移動を示さないＬ信号のままとなる。このように比較器７１ａおよび７１ｂからの出力を組み合わせ、アンド回路７２ａがＨ信号、アンド回路７２ｂおよび７２ｃがＬ信号の出力の時は、検出エリア１Ａで人体が移動したと判断する。

【０００５】これと同様に、検出エリア１Ｂのみで人体が移動したときは、比較器７１ａはＬ信号、比較器７１ｂはＨ信号となり、アンド回路７２ａと７２ｃがＬ信号、アンド回路７２ｂがＨ信号となる。また、人体の移動が重複検出エリア１Ｃのみであった場合は、比較器７１ａおよび７１ｂはともにＨ信号となり、アンド回路７２ａと７２ｂがＬ信号、アンド回路７２ｃがＨ信号となり、人体が１Ｃの検出エリアにおいて移動したと判断する。また、検出エリア１Ａと検出エリア１Ｂの位置で同時に人体移動があった場合には、比較器７１ａ、７１ｂは、ともにＨ信号となるため、アンド回路は全てＨ信号となり人体が１Ｃの重複検出エリアにおいて移動したと同様の信号を出力することになる。

【０００６】また、各検出器の感度差、あるいは、各検出器の取り付けズレによる検出エリアの設定ズレ等に起因する出力信号の位相ズレがあっても、各々の比較器は、各赤外線検出器からのリアルタイムで検出された出力信号を２値化し、そのままのＨあるいはＬ信号を出力し、この出力信号に基づいてアンド回路は人体が移動した検出エリアを判別する。従って、重複検出エリア１Ｃのみで人体の移動があった場合でも、図１４に示す通り、各赤外線検出器間の感度差や取り付けズレ等に起因して生じる出力信号の位相がズレた範囲では、赤外線検出器２ｂからの出力信号が変化しないため、比較器７１ａからはＨ信号、比較器７１ｂからはＬ信号が出力されるので、アンド回路７２ａはＨ信号で、アンド回路７２ｂおよび７２ｃはＬ信号となるため、検出エリア１Ａで人体が移動したと判断する。しかしながら、時間が経過して出力信号の位相ズレがなくなった範囲では、赤外線検出器２ｂからの出力信号が変化するため、比較器７１ａ、７１ｂからＨ信号が出力されので、アンド回路７２ａおよび７２ｂはＬ信号、アンド回路７２ｃはＨ信号となるため、検出エリア１Ｃで人体が移動したと判断する。

【０００７】

【発明が解決しようとする課題】以上説明したとおり、従来の物体検出装置によれば、後述するような不安定なタイミングで各出力波形を検出し、しかも、各赤外線検出器間の検出感度差、あるいは、人体の移動速度と各赤外線検出器の検出速度との差や、各赤外線検出器間の取り付けズレ等に起因して生じる出力信号の位相ズレを吸収せずにリアルタイムで各出力波形を比較して各検出エリアの人体有無を判断するために、各検出エリアの人体有無を精度良く、正確に判別できない。特に、各赤外線検出器が赤外線を重畳して検出する重複検出エリアでの人体有無が正確に判別できないという問題点があった。また、前述のような不安定で、しかも位相ズレを含んだ検出結果と不正確な判別基準とを比較し、この比較結果より複数の各検出エリアの人体有無を判別してるために、特に、複数の各検出エリアにそれぞれ人がいるとき、人がいるにも関わらず、人がいないと誤判断をしたり、また逆に、人がいないにも関わらず、人がいると誤判断をし、複数の各検出エリアの人体有無が正確に判別できないという問題点があった。

【０００８】この発明は、以上のような問題点を解決するためになされたもので、各検出エリア（各検出領域）の人体有無を決定する各赤外線の出力波形が最も安定して明確になるタイミングで各出力波形を検出し、しかも、各赤外線検出器間の感度差や取り付けズレ等に起因する出力信号の位相ズレの誤差を吸収した各出力波形を比較して各検出領域の人体有無、特に、各赤外線検出器が赤外線を重畳して検出する重複検出領域の人体有無を精度良く、正確に判別する信頼性の高い人体検出装置を提供することを目的とする。また、最も安定して明確になるタイミングで各出力波形を検出し、各赤外線検出器間の感度差や取り付けズレ等に起因して生じる出力信号の位相ズレの誤差を吸収した各出力波形の極大・極小数および同期極性と極大・極小数および同期極性の波形間判別基準とを、人体移動の区切りを示す各出力波形の区切りが互いに成立するたびに比較して、複数の各検出領域の人体有無を精度良く、正確に判別する信頼性の高い人体検出装置を提供することを目的とする。

【０００９】

【課題を解決するための手段】この発明に係る人体検出装置においては、一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにおいて、前記各赤外線検出器の出力波形の極大・極小の発生時刻を検出し、かつ確定する極大極小検出手段と、この確定した各出力波形の極大・極小の発生時刻の時間差から各出力波形の一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたものである。

【００１０】また、一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにお

いて、前記各赤外線検出器の出力波形の極大・極小を検出し、かつ確定する極大極小検出手段と、前記各出力波形の電圧が基準電圧とそれぞれにクロスするそれぞれの各ゼロクロスを検出するゼロクロス検出手段と、この検出した各ゼロクロスが前記各出力波形のどちらか一方で２回発生してゼロクロス間が成立したかどうかを判別する波形成立判別手段と、この波形成立判別手段の判別結果より、判別条件が成立したときは、この成立したゼロクロス間での前記各出力波形の極大・極小の符号差から各出力波形の一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたものである。

【００１１】また、一部が互いに重複する検出エリアを有する少なくとも二つ以上の各赤外線検出器で物体が放射する赤外線をそれぞれに検出するようにしたものにおいて、前記各赤外線検出器の出力波形の極大・極小を検出し、かつ確定する極大極小検出手段と、前記各出力波形の電圧が基準電圧とそれぞれにクロスするそれぞれの各ゼロクロスを検出するゼロクロス検出手段と、この検出した各ゼロクロスが前記各出力波形のそれぞれで２回発生してゼロクロス間が互いに成立したかどうかを判別する波形成立判別手段と、この波形成立判別手段の判別結果より、判別条件が成立したときは、この互いに成立したそれぞれのゼロクロス間を包括するゼロクロス区間での前記各出力波形の極大・極小数および同期極性の差と予め設定された極大・極小数および同期極性の波形間判定基準との一致度を判定する波形一致度判定手段と、この波形一致度判定手段の出力に基づいて前記物体の位置を判別する検出エリア判別手段と、を備えたものである。

【００１２】また、前記極大極小検出手段に、前記各赤外線検出器の出力波形の電圧値が予め設定された飽和しきい値幅を越えたとき、この越えた電圧値をピークカットして前記飽和しきい値幅以内に保持する飽和電圧保持手段と、この飽和電圧保持手段が保持を開始してから終了するまでの中間時間で前記各出力波形に極大・極小が発生したと判断する飽和ピーク判断手段と、を備えたものである。

【００１３】また、前記極大極小検出手段に、前記各赤外線検出器の出力波形の電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間を越えたときは、前記各出力波形が終了したと判断し、前記出力電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間以内のときは、前記各出力波形が継続していると判断する時間遅れ検出手段と、を備えたものである。

【００１４】また、波形一致度判定手段が、各赤外線検出器の出力波形間のピーク時間差および振幅比から設定したファジールールとメンバーシップ関数に基づいて各出力波形の一致度を判定するものである。

【００１５】また、波形一致度判定手段が、前記判別条件が成立し、この成立したゼロクロス区間での前記各出力波形の極大極小数および同期極性が同一の時に、このゼロクロス区間の前記各出力波形の最後の極大極小数および同期極性に基づいて各出力波形の一致度を判定するものである

【００１６】また、波形成立判別手段が、前記ゼロクロス検出手段が検出した各赤外線検出器の出力波形の終了ゼロクロスを回避して判別するものである。

【００１７】

【作用】以上のように構成された物体検出装置においては、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生時刻を検出し、かつ確定し、この確定した各出力波形の極大・極小の発生時刻の時間差から各出力波形の一致度を判定し、この判定した出力に基づいて物体の位置を判別する

【００１８】また、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生時刻を検出して確定し、また、各出力波形の電圧が基準電圧とそれぞれにクロスする各ゼロクロスを検出し、この検出した各ゼロクロスが各出力波形のどちらか一方で２回発生してゼロクロス間が成立したかどうかを判別し、この判別結果より、判別条件が成立したときは、この成立したゼロクロス間での各出力波形の極大・極小の符号差から各出力波形の一致度を判定し、この判定した出力に基づいて物体の位置を判別する

【００１９】また、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生時刻を検出して確定し、また、各出力波形の電圧が基準電圧とそれぞれにクロスする各ゼロクロスを検出し、この検出した各ゼロクロスが各出力波形のそれぞれで２回発生してゼロクロス間が互いに成立したかどうかを判別し、この判別結果より、判別条件が成立したときは、この互いに成立したそれぞれのゼロクロス間を包括するゼロクロス区間での極大・極小数および同期極性の差と予め設定された極大・極小数および同期極性の波形間判定基準との一致度を判定し、この判定した出力に基づいて物体の位置を判別する。

【００２０】また、極大極小検出手段が、各赤外線検出器の出力波形の電圧値が予め設定された飽和しきい値幅を越えたとき、この越えた電圧値をピークカットして飽和しきい値幅以内に保持し、この保持を開始してから終了するまでの中間時間で各出力波形に極大・極小が発生したと判断する。

【００２１】また、極大極小検出手段が、各赤外線検出器の出力波形の電圧値が予め設定された下限しきい値内

に維持される時間が所定時間を越えたときは、各赤外線波形の検出が終了したと判断し、また、出力電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間以内のときは、各出力波形が継続していると判断する。

【0022】また、波形一致度判定手段が、各赤外線検出器の出力波形間のピーク時間差および振幅比から設定したファジールールとメンバーシップ関数に基づいて各出力波形の一致度を判定する。

【0023】また、波形一致度判定手段が、判別条件が成立し、この成立したゼロクロス区間での各出力波形の極大極小数および同期極性が同一の時に、このゼロクロス区間の各出力波形の最後の極大極小数および同期極性に基づいて各出力波形の一致度を判定する

【0024】また、波形成立判別手段が、各赤外線検出器の出力波形の終了ゼロクロスを回避して各ゼロクロスを判別する。

【0025】

【実施例】

実施例1．図1～図2は、この発明の一実施例を示す図で、図1は実施例1の人体検出装置のブロック構成図、図2は、実施例1の各赤外線検出器の出力波形図である。、図4は各赤外線検出器が検出する波形信号の処理手順を示す流れ図であり、図12は各赤外線検出器が出力した波形間の出力波形状況をしめしたものである。なお、従来装置と同一のものは同一符号で示す。

【0026】図1において、1A～1Cは赤外線の検出エリア、2aおよび2bは赤外線を検出する赤外線検出器、なお検出エリアのうち1Cは赤外線検出器2aと2bが赤外線を重畳して検出する重複検出エリアである。また、3aおよび3bは赤外線検出器2a、2bの出力信号を増幅する増幅手段、6aおよび6bは、この増幅手段3a、3bの増幅した出力波形の電圧が予め設定された下限しきい値幅以上の振幅を持つかどうか判断する信号検出手段、14aおよび14bは、赤外線の出力波形の極大極小を後述する波形判定基準に基づいて検出し、この検出した出力波形の極大極小の発生時刻を確定する極大極小発生検出手段、8aおよび8bは、極大極小発生検出手段14aおよび14bに内蔵され、出力波形の極大極小が検出されたときその電圧値を計測保持するピーク電圧計測保持手段、9aおよび9bは、極大極小発生検出手段14aおよび14bに内蔵され、出力波形の極大極小が検出されたときその時刻を計測保持するピーク時刻計測保持手段、10は各赤外線検出器の出力波形の極大極小の電圧値および発生時刻の情報から得られる各出力波形の極大極小時刻と予め設定された出力波形間の差を示す時刻基準とを比較する波形一致度判定手段、11はこの波形一致度判定手段10の比較結果より各検出エリア1A～1Cでの人体の有無を判定する検出エリア判別手段である。

【0027】以下に実施例1の人体検出装置の動作について説明する。まず、各赤外線検出器2a、2bが人体から放射される赤外線を一部が重複する各検出エリア1A～1Cからそれぞれ検出し、この検出した赤外線の出力波形変化と波形判定基準（出力波形の傾きがプラス→0→マイナスに変化したときの時刻を極大時刻，マイナス→0→プラスに変化したときの時刻を極小時刻と判定する基準）とを比較し、この比較結果より各出力波形の極大・極小の時刻を極大極小発生検出手段14a、14bが確定する。次に、この確定した各出力波形の極大・極小の発生時刻と予め設定された出力波形間の差を示す時刻基準とを波形一致度判定手段10が比較し、赤外線検出器2aからの出力波形に極大・極小のピーク時刻が確認され、この確認された時刻から予め設定された時刻基準（たとえば1秒）が経過しても、他方の赤外線検出器2bからの波形に極大・極小の時刻が確認されないときは、検出エリア1Aに人体有りと判定し、また逆に、赤外線検出器2bからのみの波形にピーク時刻が確認され、この確認された時刻から設定時刻基準が経過しても赤外線検出器2aの波形に極大・極小のピーク時刻が確認されないときは、検出エリア1Bに人体有りと判定する。また、各赤外線検出器2a、2bの両方の出力波形に極大・極小のピーク時刻が設定時刻基準内で確認されたときは、検出エリア1Cに人体有りと判定する。

【0028】また、図2に示すとおり、各波形の極大・極小の時刻を比較して人体有無を判断すると、各赤外線の出力波形は、基準電圧値の付近では波形勾配がゆるやになり、各赤外線波形間の検出ズレが大きくなる。特に、人体の移動が停止したことを示す最終波形、即ち、ゆり戻し波形は最も波形勾配が緩やかになるために、益々各赤外線の出力波形間の検出のズレが大きくなるために、これらを基準として各赤外線の出力波形を確認する従来の検出装置では、各出力波形の確認が不明確であり、かつ不安定になるために、各エリアの人体有無を正確に判定できないという問題点があった。これに対し、各赤外線の出力波形の極大・極小のピークの時刻を検出すれば、波形勾配は極大・極小時に最も急激に変化するため、最も明確で、最も安定した状態で、各波形を正確に検出でき、しかも、この検出した各波形間の極大・極小時刻差は、図2に示すとおり、ほぼ一定になるので、各出力波形間の差がより正確になる。

【0029】なお、上記説明では、2つの赤外線検出器を組合わせて利用する場合について述べたが、3つ以上の各赤外線検出器で構成して利用するときは、互いの隣接する各赤外線検出器毎に順次組合わせ、この組合わせ毎の各検出エリアの人体有無を順次判別して行くようにする。

【0030】以上説明したように、各出力波形の極大・極小時刻差と設定時刻との差によって、各赤外線検出器間の感度差や取り付けズレなどに起因して生じる各出力

波形の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の最も安定して明確になる極大・極小の発生時刻の時間差を比較して各検出エリアの人体有無を判定するために、各検出エリア、特に、重複した検出エリアの人体有無を精度良く、正確に判別する信頼性の高い人体検出装置が得られる。

【００３１】実施例２．図３～図５は、この発明の一実施例を示す図で、図３は実施例２の人体検出装置のブロック構成図であり、この図３は、実施例１の図１の手段に後述する時間遅れ信号検出手段と、ゼロクロス検出手段と、波形判定条件成立判別手段とを追加したものである。なお、図３の増幅手段以後の手段はマイクロコンピュータで実現する。また、図４は赤外線検出器の出力波形と波形情報計測保持の様子を示す模式図
図５は各赤外線検出器が検出する波形信号の処理手順を示す流れ図である。図３は前述の通り、図１の実施例１に各種手段を追加し、さらに細かく情報を収集し、精度よい判断を可能とするようにしたもので、この図３の２０はマイコン、１２ａと１２ｂはＡ／Ｄ変換器、１３ａと１３ｂはＡ／Ｄ変換器１２ａ、１２ｂからの赤外線出力信号が下限しきい値幅を越えたときに検出を開始し、また、信号が下限しきい値幅以内に入ってもある一定時間内に再びしきい値を越えれば検出を継続、越えなければ終了とする時間遅れ信号検出手段、１４ａと１４ｂは、信号波形の傾きがプラス→０→マイナスとなる極大、および、マイナス→０→プラスとなる極小を検出する極大極小発生検出手段、１５ａと１５ｂは極大極小発生検出手段１４ａあるいは１４ｂで極大極小発生が検出されたとき、その電圧値を計測および保持する極大極小検出保持手段、１６ａと１６ｂは極大極小発生検出手段１４ａあるいは１４ｂで極大極小発生が検出されたとき、その発生時刻を計測および保持する極大極小時刻計測保持手段、１７ａと１７ｂは極大極小発生手段１４ａあるいは１４ｂで極大極小発生が検出されたとき、その数を計数および保持する極大極小計数保持手段、１８ａと１８ｂは信号のバイアス基準電圧と信号波形が交差する通常ゼロクロスおよび信号波形の開始・終了時の開始・終了ゼロクロスの発生を検出し、計数するゼロクロス検出計数手段、１９は時間遅れ信号検出手段１３ａ，１３ｂ、極大極小発生検出手段１４ａ，１４ｂ、および、ゼロクロス検出計数手段１８ａ，１８ｂからの検出情報に基づいて、ゼロクロスが各赤外線波形のどちらか一方で２回発生してゼロクロス間が成立しかどうかをを判別する波形判定条件成立判別手段である。なお、ここでの波形一致度判定手段１０は波形判別手段１８ａ，１８ｂの判別結果と予め設定された極大極小の波形間判定基準とを比較し、この比較結果に基づいて各検出エリア１Ａ～１Ｃの人体有無を検出エリア判別手段１１が判別する。

【００３２】図４において、２１は人の動きがないとき、すなわち、赤外線検出器の出力信号に変動がないことを示す基準となるバイアス基準電圧、２２は人が動いたときの赤外線検出器の出力波形の一例、２３は基準電圧２１より大きい電圧に設定された信号発生検出しきい値上限電圧、２４は基準電圧２１より小さい電圧に設定された信号発生検出しきい値下限電圧、２５は信号発生検出状態を示すタイムチャートで、２５ａ，２５ｃ，２５ｅ，２５ｇ，２５ｉは出力波形が赤外線検出器の出力波形２２が信号発生検出しきい電圧２３，２４を越えて信号発生を検出開始した時刻を示す、２５ｂ，２５ｄ，２５ｆ，２５ｈ，２５ｊは、出力波形が赤外線検出器の出力波形２２が信号発生検出しきい電圧２３，２４以内となり、信号発生の検出終了を示す時刻、２６は信号発生検出終了後一定時間内に再び信号発生検出が開始されたときに、信号発生の検出が継続しているようにする時間遅れ信号発生検出のタイムチャート、２６ａは時間遅れ信号の発生を検出したときの信号検出開始時刻、２６ｂは時間遅れ信号の発生を検出したときの信号検出終了時刻をそれぞれ示す。また、２７ａ，２７ｂ，２７ｃは赤外線検出器の出力波形の極大電圧、２８ａ，２８ｂ，２８ｃは同じく極大発生時刻、２９ａ，２９ｂ，２９ｃは同じく極小電圧、３０ａ，３０ｂ，３０ｃは極小発生時刻、３１は極大極小検出のタイムチャートである。３２はゼロクロス検出のタイムチャートであり、３２ａは信号検出開始をゼロクロスとする開始ゼロクロス、３２ｂ，３２ｃ，３２ｄ，３２ｅは信号検出中に基準電圧２１と出力波形２２が交差する通常ゼロクロス、３２ｆは信号検出終了をゼロクロスとする終了ゼロクロスを示す。

【００３３】図5において、３３ａ，３３ｂ・・・は、各赤外線検出器の出力波形に対する情報収集処理ブロックを示し、赤外線検出器と同数のブロックが必要である。３３ａ，３３ｂはマイコンで処理する場合、並列には処理されず、３３ａの処理が終了後３３ｂの処理を順次実行するのが一般的である。また、Ｆ１～Ｆ１３は、それぞれの機能を実現する処理ブロック、１０，１１および１３～１９は図３において、それぞれ対応する手段を実現する処理ブロックである。なお、矢印は処理の流れ、Ｙは条件が成立したときに処理が進む分岐、Ｎは条件が成立しなかったときに処理が進む分岐をそれぞれ示す。

【００３４】次に、図３の検出エリア１Ａのみで人体の移動があったときについて、図４の出力波形および図５のフローチャートに基づいて信号処理の流れを説明する。

【００３５】検出エリア１Ａで人体が移動した場合、遠赤外線放射体である人体の移動にともない、赤外線検出器２ａの受光する赤外線が変化するため、例えば、図４に示したような出力波形２２が発生する。一方、赤外線検出器２ｂでは、検出エリア１Ｂまたは１Ｃ内での人体

の移動がないため、赤外線検出器２ｂの受光する赤外線が変化せず、基準電圧２１近傍のバイアス電圧のままとなり、出力波形は変動しない。そこで、説明のため、基準電圧２１を示す線を赤外線検出器２ｂの出力波形とする。

【００３６】まず、赤外線検出器２ａの出力信号２２および赤外線検出器２ｂの出力信号すなわち基準電圧２１は、それぞれＡ／Ｄ変換器１２ａおよび１２ｂによってアナログ信号からデジタル信号に変換される。ここで、Ａ／Ｄ変換と信号処理とは周期的に繰り返されるものである。すなわち、Ａ／Ｄ変換後信号処理、再びＡ／Ｄ変換後信号処理、というように、Ａ／Ｄ変換並びに信号処理が少なくとも赤外線検出器の出力波形が安定するまでは繰り返されるものである。

【００３７】ここで、波形ピークの一致度を判別する必要から、Ａ／Ｄ変換は、時間的に同一時刻で各赤外線検出器の出力波形をＡ／Ｄ変換することが望ましいが、波形の変化に対して十分に短い間隔でＡ／Ｄ変換できれば、同一時刻でのピーク一致度の判別としても発明の効果を妨げない。

【００３８】信号検出処理ブロック１３では、信号発生を調べ処理の分岐を行う。

【００３９】まず、信号検出処理Ｆ１において、Ａ／Ｄ変換により得られた出力波形デジタル信号の値が、信号発生基準電圧２３以上になったとき、あるいは、信号発生基準電圧２４以下になったときに信号発生フラグをセットする。それ以外のときは信号発生フラグをリセットする。

【００４０】次いで、Ｆ２では、信号発生フラグがセットされているとき、ＹすなわちＦ３の処理へ、セットされていないとき、ＮすなわちＦ１１の処理へそれぞれ分岐する。つまり、信号発生が検出されたとき、極大極小検出、ゼロクロス検出等の処理を実行し、信号発生が検出されないときは、極大極小検出、ゼロクロス検出等の処理を実行しない。

【００４１】極大極小検出処理ブロック１４では、極大極小の発生を調べ、処理の分岐を行う。

【００４２】まず、極大極小検出処理Ｆ３において、出力波形の傾きが、プラス→０→マイナスに変化したときは極大、また、マイナス→０→プラスに変化したときには極小の発生フラグをセットする。それ以外のとき極大極小発生フラグをリセットする。

【００４３】次いで、Ｆ４では極大極小発生フラグがセットされているとき、ＹすなわちＦ５の処理へ、セットされていないとき、ＮすなわちＦ８の処理へそれぞれ分岐する。つまり、極大極小が検出されたとき、電圧、時刻、計数等に対する処理を実行し、極大極小が検出されないときは、電圧、時刻、計数等に対する処理を実行しない。

【００４４】極大極小電圧計測保持処理ブロック１５またはＦ５では、極大あるいは極小と判断されたとき、その電圧値を保持メモリに格納する。

【００４５】極大極小時刻計測保持処理ブロック１６またはＦ６では、極大あるいは極小と判断されたとき、その時刻を保持メモリに格納する。

【００４６】極大極小時刻計数保持処理ブロック１７またはＦ７では、極大あるいは極小と判断されたとき、その判断期間内での極大極小発生の合計数を保持メモリに格納する。

【００４７】ゼロクロス検出処理ブロック１８では、ゼロクロスの発生を調べ、処理の分岐を行う。

【００４８】まず、ゼロクロス検出処理Ｆ８では、信号検出開始の場合、または、前回出力波形の値が基準電圧より大で、かつ、今回出力波形の値が基準電圧以下の場合、または、前回出力波形の値が基準電圧より小で、かつ、今回出力波形の出力波形の値が基準電圧以上の場合、または、信号検出終了の場合には、ゼロクロス発生フラグをセットし、それ以外のときは、ゼロクロス発生フラグをリセットする。

【００４９】次いで、Ｆ９ではゼロクロス発生フラグがセットされているとき、ＹすなわちＦ１０の処理へ、セットされていないとき、ＮすなわちＦ１１の処理へそれぞれ分岐する。つまり、ゼロクロス発生が検出されたとき、ゼロクロス計数処理を実行し、それ以外のときはゼロクロス計数の処理を実行しない。

【００５０】各赤外線検出器の出力波形に対する情報収集処理ブロック３３ａ，３３ｂ・・・の処理が終了後、判定条件分岐処理ブロック１９，Ｆ１１では、判定条件が満足したかどうかを調べ、処理の分岐を行う。

【００５１】Ｆ１１では、一つの赤外線検出器の出力波形のみが信号検出されていて２回ゼロクロスが発生した場合と、二つ以上の赤外線検出器の出力波形が信号検出されていてそのいずれか一方で少なくとも２回以上ゼロクロスが発生した場合には、ＹすなわちＦ１２の処理へ、それ以外のときＮの処理へ分岐する。つまり、そのいずれか一方で少なくとも２回以上のゼロクロスが発生していると言う判定条件を満足したときピーク一致度判定、検出エリア判別等の処理を実行し、それ以外のときピーク一致度判定、検出エリア判別等の処理を実行しない。

【００５２】即ち、波形一致度判定手段１０が処理するブロック１０のＦ１２では、各赤外線検出器から出力波形の信号が検出され、例えば、各赤外線検出器ごとに保持している極大極小電圧値および発生時刻の情報から、成立したゼロクロス間で出力波形の極大を赤外線検出器２ａ，２ｂが互いに検出した場合は、各赤外線検出器２ａ，２ｂが互いに検出する重複検出エリア１Ｃでの人体移動の出力波形と同じであると波形間判定基準にもとづいて判定し、また、各出力波形の極大・極小が互いに異なる場合には、出力波形の極大信号を発している側の赤

外線検出器２ａまたは２ｂのそれぞれ単独で検出している単検出エリア１Ａ，１Ｂでの人体移動の出力波形と同じであると波形間判定基準にもとづいて判定する。

【００５３】検出エリア判別処理ブロック１１のＦ１３では、波形一致度判定処理ブロック１０で得られた判定結果より、成立したゼロクロス間で、一つの赤外線検出器のみで出力波形の極大・極小が検出された場合には、その出力波形の極大・極小信号を発している赤外線検出器の単検出エリアでの人体移動であると判別し、複数の赤外線検出器で出力波形信号が検出され、互いに出力波形の極大・極小を検出した場合には、重複した検出エリア１Ｃでの人体移動であると検出エリア判別手段１１が判別する。　次いで、情報の初期化を実行するので、再び各Ａ／Ｄ変換器により各赤外線検出器２ａ，２ｂの出力波形を取り込み、同様の処理を継続して繰り返すことで、人体が移動する度毎にどの検出エリアに移動したかについての情報を得ることができる。

【００５４】なお、上記説明では、２つの赤外線検出器を組合わせて利用する場合について述べたが、３つ以上の各赤外線検出器で構成して利用するときは、互いの隣接する各赤外線検出器毎に順次組合わせ、この組合わせ毎の各検出エリアの人体有無を順次判別して行くようにする。

【００５５】以上説明した通り、本実施例では、常に、ゼロクロスがいずれか一方で少なくとも２回以上発生して成立したゼロクロス間によって各赤外線検出器間の感度差や取付ズレ等によって生じた各出力波形の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の最も安定して明確になる極大・極小を比較して各検出エリアの人体有無を判別するために、各検出エリアの人体有無を精度良く、正確に判定すると共に、特に、各赤外線検出器が互いに検出する重複検出エリアの人体有無を正確に検出する信頼性の高い人体検出装置が得られる。

【００５６】実施例３．図６は、この発明の更に他の一実施例を示す図で、赤外線検出器の出力波形が飽和した場合の極大極小検出の様子を示す模式図である。

【００５７】図６において、２１は基準電圧、２２は赤外線検出器の出力波形、３４は増幅回路の最大出力可能電圧、３５は増幅回路の最小出力可能電圧、３６は極大飽和検出しきい電圧、３７は極小飽和検出しきい電圧、２７ａ，２７ｂは飽和していない極大、３８は飽和している極大、３９は極大飽和開始時刻、４０は極大飽和終了時刻、４１は極大飽和時刻、２９ａは飽和していない極小、４２は飽和している極小、４３は極小飽和開始時刻、４４は極小飽和終了時刻、４５は極小飽和発生時刻をそれぞれ示す。

【００５８】図６に基づいて、飽和する極大極小が発生した場合のこの発明の動作を説明する。

【００５９】ある赤外線検出器で、図６のような出力波形２２が発生した場合、飽和していない極大２７ａ，２７ｂ、極小２９ａは、実施例１に示したように、出力波形の傾きの変化から極大極小の発生を検出し、その情報を各処理ブロックで処理して計測保持する。

【００６０】しかし、実際の一般的な増幅回路では、出力可能な電圧範囲はオペアンプの電源電圧により制限されており、入力が大きいと、出力電圧がオペアンプの出力限界電圧に達し、制限電圧を出力し続ける飽和状態が発生する。従って、飽和した極大３８あるいは飽和した極小４２が発生した場合は、出力波形の傾き０の状態が一定時間継続するために、飽和していない極大極小を検出する方法と同一の方法では必要な波形情報の検出ができないことが多く、検出エリア判別精度が低下してしまう。

【００６１】そこで、最大出力可能電圧３４より少し小さい電圧値を極大飽和検出しきい電圧３６、最小出力可能電圧３５より少し大きい電圧値を極小飽和検出しきい電圧３７として設定し、出力波形が極大飽和検出しきい電圧３６以上の電圧値となった場合を極大飽和３８として、極小飽和検出しきい電圧３７以下の電圧値となった場合を極小飽和４２として、飽和していない極大極小と区別して検出する。

【００６２】次いで、極大飽和が発生した場合、極大飽和開始時刻３９と極大飽和終了時刻４０を保持し、極大飽和終了したときに、極大飽和電圧を極大飽和検出しきい電圧３６とし、極大飽和開始時刻３９と極大飽和終了時刻４０の中間時刻の極大飽和時刻４１で、極大が発生したと極大極小検出手段１４ａ，１４ｂが判断し、また、極小飽和が発生した場合、極小飽和開始時刻４３と極小飽和終了時刻４４を保持し、極小飽和終了したときに、極小飽和電圧を極小飽和検出しきい電圧３７とし、極小飽和開始時刻４３と極小飽和終了時刻４４の中間時刻の極小飽和時刻４５で、極小が発生したと判断する。なお、これ以降の動作は実施例２で説明したとおりである。

【００６３】実施例４．図７～図９は、この発明の更に他の実施例を説明する図であり、図７はファジー推論の入出力系の説明図、図８はファジールールとメンバーシップ関数を示す図、図９は出力マップ図である。

【００６４】図７において、４６はファジー推論部、４７，４８はファジー推論部４６の入力、４９は出力である。

【００６５】図８において、５０はピーク一致度を求めるためのファジー推論部のルール、５１～５３はファジー推論のメンバーシップ関数で、５１はピーク時間差Ｔｄの、５２は振幅比Ｖｐｈの、５３はピーク一致度ＢＡＲＡのメンバーシップ関数をそれぞれ表している。

【００６６】図９において、５４，５５は図８のルールとメンバーシップ関数で描かれた出力マップであり、５６はその境界を表している。

【００６７】次に、この実施例の動作を図７に基づいて

説明する。

【0068】実施例1および実施例2におけるピークの波形一致度判定手段10の換わりに実現する手段として、あらかじめテーブルでデータを持たせるテーブル参照方式、ファジー推論を利用する等が考えられる。テーブル参照方式では、分解能が粗くてもよい場合には適しているが、細かな判断を行わせようとすると膨大なテーブルを持たなければならず、現実的ではない。これに対し、ファジー推論はデータとデータの間を埋める補間手段としても利用できるため、きめ細かな分解能を簡単に得られる。また、ファジー推論、ルール、メンバーシップ関数の設計も簡単であり、非常に使いやすい利点を持つ。

【0069】まず、実際の赤外線検出器の出力波形をピーク時間差Ｔｄと振幅比Ｖｐｈのデータからそれぞれマッピングすると図9に示したようになり、境界線５６によって明らかに分離できる。そこで、この図を基に、ファジールール５０とメンバーシップ関数５１～５３を作成する。これをファジー推論部に持たせる。

【0070】今、図9に示したデータ以外の人体移動によるピーク時間差Ｔｄと振幅比Ｖｐｈが入力された場合でも、ファジーの補間効果でピーク一致度が出力される。ここでは、０～２５５の整数で出力され、０～１３０がピーク不一致、１３１～２５５がピーク一致を表す。

【0071】このように、ファジー推論を用いると少ないサンプルデータからでも、きめ細かな判定を行うためのルールとメンバーシップ関数が簡単にでき、また、データとして持っていない部分の入力に対しても、正確な出力を得ることができ、しかも、設計が非常に簡単で使いやすいという特徴を持つ。

【0072】実施例5．図１０は、この発明の更に他の実施例における出力波形図であり、各赤外線検出器の出力波形が、互いに少なくとも２回以上ゼロクロスしたという判定条件を満足し、かつ複数の同一ピークが同期して発生した場合の一部を表したものである。なお、このような波形は、重複検出エリアへの出入りする人体の移動が短時間で繰り返されたときに発生する。

【0073】図１０において、２１は基準電圧を、５７ａは赤外線検出器２ａの出力波形を、５７ｂは赤外線検出器２ｂの出力波形を、５８ａ，５９ａ，６０ａは赤外線検出器２ａの出力波形のピーク（極大極小）を、５８ｂ，５９ｂ，６０ｂは赤外線検出器２ｂの出力波形のピーク（極大極小）を、６１ａ，６２ａは赤外線検出器２ａの出力波形のゼロクロス点を、６１ｂ，６２ｂは赤外線検出器２ｂの出力波形のゼロクロス点を、それぞれ示す。なお、この図１０において、赤外線検出器２ａの出力波形の最大ピークおよび最新ピークとは同じ６０ａであり、赤外線検出器２ｂの出力波形の最大ピークは５８ｂ、最新ピークは６０ｂである。

【0074】次に、この実施例の動作を図１０に基づいて説明する。

【0075】まず、赤外線検出器２ａのゼロクロス６１ａが発生し、次いで、赤外線検出器２ｂのゼロクロス６１ｂが発生する。次に、赤外線検出器２ａのピーク５８ａおよび赤外線検出器２ｂのピーク５８ｂがほぼ同時に発生する。この時それぞれのピークの電圧および発生時刻を計測保持し、ピーク数を計数する。この時点では、ピーク数は各赤外線検出器とも１である。次いで、順次各赤外線検出器の出力波形のピーク５９ａ，５９ｂ，６０ａ，６０ｂの情報が得られる。そして、赤外線検出器２ｂのゼロクロス６２ｂが発生し、次いで、赤外線検出器２ａの出力波形のゼロクロス６２ａが発生する。ゼロクロス６２ａが発生した時点で、各赤外線検出器の出力波形が互いに少なくとも２回以上ゼロクロスが発生して互いゼロクロス間が成立したという判定条件を満たしたときに、波形判定の処理が実行される。

【0076】次に、波形判定処理としては、まず、判定期間６１ａ～６２ａ内におけるピーク発生数が同一であるから、ピークが一致したと判定する。このとき発生したピークのうち全てのピークの組で判定すると、ピーク数に対応したピーク情報格納メモリが必要になり、処理をピーク数分繰り返すので処理時間も長くかかる。そこで、最新ピークの電圧値および発生時刻で判断するようにすると、メモリを少なくでき、処理時間も短縮できる。また、全てのピークの組で判定し、時間的に前のピークの電圧値および発生時刻で人体の移動位置を判断しても、最終的には、時間的に直前のピークによる判定結果が有効となるため、最新ピークの電圧値および発生時刻を使ってピーク一致度の判定を実行するほうが効率がよい。

【0077】従って、ピーク情報収集処理において、最新のピークの電圧値および発生時刻を順次更新していくピーク情報保持手段（図示せず）を波形一致度判定手段１０内に設けると良い。

【0078】実施例6．図１１は、この発明の更に他の実施例の各赤外線検出器の出力波形が、互いに少なくとも２回以上ゼロクロスして互いにゼロクロス間が成立したという判定条件を満足した場合の波形図である。

【0079】図１１において、２１は基準電圧を、６３ａは赤外線検出器２ａの出力波形を、６３ｂは赤外線検出器２ｂの出力波形を、６４ａは赤外線検出器２ａの出力波形のピーク（極大極小）を、６５ａ，６５ｂ，６５ｃ，６５ｄ，６５ｅは赤外線検出器２ａの出力波形のピーク（極大極小）を、６６ａ，６７ａは赤外線検出器２ａの出力波形のゼロクロス点を、６６ｂ，６７ｂは赤外線検出器２ｂの出力波形のゼロクロス点を、それぞれ示す。

【0080】次に、この実施例の動作を図１１を参照して説明する。なお、本実施例の波形判定条件成立判別手

段１９、波形一致度判定手段１０および検出エリア判別手段１１は、下記に記述したとおりの動作をするが、この他の手段動作は実施例２で説明したとおりなので、その他の動作の説明は割愛する。

【００８１】まず、赤外線検出器２ａの出力波形のゼロクロス６６ａが発生し、次いで、赤外線検出器２ｂのゼロクロス６６ｂが発生する。次に、赤外線検出器２ｂの出力波形のピーク６５ａが発生し、電圧値、発生時刻を計測し、ピーク発生数を計数し、ピーク情報を記憶保持する。この時点では、赤外線検出器２ａの出力波形のピーク数は０、赤外線検出器２ｂの出力波形のピーク数は１である。次いで、順次各赤外線検出器の出力波形のピーク６５ａ，６５ｃ，６４ａ，６５ｄ，６５ｅの情報が得られる。そして、赤外線検出器２ａの出力波形のゼロクロス６７ｂが発生し、次いで、赤外線検出器２ｂの出力波形のゼロクロス６７ｂが発生する。ゼロクロス６７ｂが発生した時点で、各赤外線検出器が互いに少なくとも２回以上ゼロクロスし、互いにゼロクロス間が成立したかどうかを波形成立判別手段１９が判別し、波形判別条件が成立したとき、この互いに成立したゼロクロス間を包括するゼロクロス区間で波形判定の処理が実行される。

【００８２】次に、波形判定としては、例えば、この互いに成立したゼロクロス間を包括するゼロクロス区間であるゼロクロス６６ａからゼロクロス６７ｂまでの範囲で、各赤外線検出器の出力波形の極大極小数および同期極性と予め設定された波形間差を示す極大極小数および同期極性の波形間判定基準とを比較し、この互いに成立したゼロクロス区間で、同期極性が同一の出力波形が発生し、かつ、各赤外線検出器２ａ，２ｂで検出したピーク数が異なるという状況にある時は、まず、各赤外線検出器の重複エリア１Ｃに人体が移動したものと推測する。一方、赤外線検出器２ｂの出力波形に、小さなピークが複数ある波形となっているので、これは、上記重複エリア１Ｃ以外のエリアでも、人体移動があった。即ち、赤外線検出器２ｂのピーク数が多いことより、単エリア１Ｂでも人体移動があったと波形一致度判定手段１０が推測する。なお、前述の判定条件状況で、赤外線検出器２ａのピーク数が多いときには、、重複エリア１Ｃと単エリア１Ａで人体移動があったと推測する。また、同期極性が同一、かつ、各赤外線検出器２ａ，２ｂの検出したピーク数が同一の時は、重複エリア１Ｃでの人体の移動であると推測する。また、同期極性が異なる出力波形が発生し、かつ、各赤外線検出器２ａ，２ｂの検出したピーク数が同一の時は、単エリア１Ａおよび１Ｂのそれぞれで人体の移動があったと推測する。

【００８３】従って、波形判定条件が成立し、複数の各赤外線検出器２ａ，２ｂが検出した出力波形のピーク数が異なる時は、重複エリアとピーク数を多く検出している赤外線検出器側の単エリアとの両方で人体移動であると検出エリア判別手段１１が判別する。また、同期極性が異なる出力波形が発生し、かつ、各赤外線検出器２ａ，２ｂの検出したピーク数が同一の時は、単エリア１Ａおよび１Ｂのそれぞれで人体の移動があったと判別する。

【００８４】なお、上記説明では、２つの赤外線検出器を組合わせて利用する場合について述べたが、３つ以上の各赤外線検出器で構成して利用するときは、互いの隣接する各赤外線検出器毎に順次組合わせ、この組合わせ毎の各検出エリアの人体有無を順次判別して行くようにする。

【００８５】以上説明したとおり、互いに成立したゼロクロス間を包括するゼロクロス区間内、即ち、人体の移動の区切りを示す出力波形の区切りが互いに成立するごとに、この成立したゼロクロス区間によって各赤外線検出器間の感度差や取付ズレ等によって生じた各出力波形の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の最も安定して明確になる各出力波形の極大極小数および同期極性と予め設定された極大極小数および同期極性の波形間判定基準とを比較して判断するために、装置の判断分解能が向上し、各検出エリア１Ａと１Ｃでの人体移動、各検出エリア１Ｂと１Ｃでの人体移動、あるいは、各検出エリア１Ａと１Ｂでの、複数の検出エリアの人体移動を精度良く、正確に判別する。

【００８６】実施例７．図１２は、この発明の更に他の実施例を示す図で、一般的な赤外線検出器の出力波形を示したものである。

【００８７】図１２において、２１は基準電圧を、２３，２４は信号発生検出しきい電圧を、６８ａ，６８ｂ，６８ｃ，６８ｄ，６８ｅは出力波形のピーク（極大極小）を、６９ａ，６９ｂ，６９ｃ，６９ｄ，６９ｅ，６９ｆは出力波形のゼロクロス点を、特に６９ｆは終了ゼロクロス点を、７０は波形判定を回避する期間をそれぞれ表す。

【００８８】次に、この実施例７の動作を図１２を参照して説明する。

【００８９】まず、人体移動により赤外線検出器の出力波形が変化し、信号発生しきい電圧を越えると、信号発生検出処理により信号発生検出され、開始ゼロクロス６９ａが検出される。次いで、６８ａの出力波形のピークが検出され、ピーク情報が計測保持される。次に、６９ｂの出力波形のゼロクロス点が検出される。このとき、判定条件が成立すれば、得られた情報に応じて、ピーク一致度判定、検出エリア判別などの処理が実行される。以下順次、信号検出、ピーク検出、ゼロクロス検出等の処理および波形判定、検出エリア判別等の処理が実行されていく。そして、終了ゼロクロス点６９ｆが検出され信号検出が終了し、人体移動位置が判別される。

【００９０】しかし、上記のように、終了ゼロクロス一つ前のゼロクロス（６９ｅ）から終了ゼロクロス６９ｆ

の間の波形は、赤外線検出器の出力を帯域増幅するときに生じる波形であり、ここでは、ゆり戻し波形と呼ぶことにする。このゆり戻し波形は、本来赤外線検出器の出力情報以外に増幅器の時間遅れ成分が多く含まれるため、ゆり戻し波形の情報により人体移動があった検出エリアの判別を行うと、検出精度が低下することが実験によりわかった。

【００９１】そこで、判定条件が成立し、この条件を満たした赤外線検出器の出力波形のゼロクロスが終了ゼロクロスであった場合は、終了ゼロクロスの一つ前のゼロクロス６９ｅから終了ゼロクロス６９ｆの間の波形、すなわち、ゆり戻し波形の情報を無視するようにし、この情報の回避基準を波形判別基準に反映させると、この回避基準を加味して波形条件成立判別手段１９が各出力波形のゼロクロスの成立条件を判別するようになる。

【００９２】実施例８．なお、実施例２の極大極小検出手段１４ａ、１４ｂに、各赤外線検出器の検出した各出力波形の出力電圧値が予め設定された下限しきい値幅内に所定時間を越えても維持されているときは、各出力波形が終了したと判断し、出力電圧値が予め設定された下限しきい値幅内に所定時間以内で維持されるときは、各出力波形が継続していると判断する時間遅れ検出手段１３ａおよび１３ｂとを追加し、極大極小検出手段１４ａ、１４ｂが時間遅れ検出手段３ａ、１３ｂの判断結果に基づいて各出力波形の極大極小を確定するようにすれば、極大極小検出手段は、各出力波形の出力電圧値が予め設定された下限しきい値内に所定時間を越えても維持されているときは、各出力波形が終了したと判断し、また、出力電圧値が予め設定された下限しきい値幅内に所定時間以内で維持されるときは、各出力波形が継続していると判断してから次の動作に移るようになる。なお、これ以降の動作は、実施例２で説明しているので割愛する。

【００９３】従って、下限しきい値幅により各出力波形のノイズを除去し、また、所定時間により各赤外線の最終波形で発生するゆり戻し波形の検出終了を確定すると共に、下限しきい値幅以内で一時不連続になる各出力波形を連続しているように検出するため、ノイズによる誤判断を防止し、また、各出力波形の最終のゆり戻し波形による検出未終了の誤情報を防止し、かつ、各出力波形を連続した安定状態で検出する信頼性の高い人体検出装置が得られる。

【００９４】なお、この実施例８と実施例６とを組合せると、各赤外線検出器２ａ、２ｂからの互いの出力波形の信号が常になくても、信号がない方の赤外線検出器の出力波形の電圧値が予め設定された下限しきい値内に所定時間を越えても維持されるときは、実施例８の極大極小検出手段１４ａ、１４ｂが、信号がない方の赤外線検出器からの出力波形が終了したと判断して、終了ゼロクロスが成立し、この成立した終了ゼロクロスと開始ゼロクロスとによってゼロクロス間が常に成立するために、もう一方の信号が有る赤外線検出器の出力波形のみの各ゼロクロス間波形特性で各検出エリアの人体有無が決定されることになる。従って、実施例６で説明した複数の各検出エリアの他に、単数の各検出エリアでの人体有無も正確に判別するようになることは言うまでもない。

【００９５】ところで、上記説明では、この発明を人体の検出に利用する場合について述べたが、その他の熱源として赤外線を発するような物体の検出に利用できることはいうまでもない。

【００９６】

【発明の効果】以上のように構成された物体検出装置においては、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生時刻を検出し、かつ確定し、この確定した各出力波形の極大・極小の発生時刻の時間差から各出力波形の一致度を判定し、この判定した出力に基づいて物体の位置を判別の物体の位置を判別するので、各出力波形の極大・極小発生時刻差と設定時間基準との差によって各赤外線検出器間の感度差や取付ズレに起因する各出力波形間の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の、勾配の急激な変化により、最も安定して明確になるの極大・極小を比較して物体の位置を判別するため、各検出エリアの物体の位置を精度良く、正確に検出すると共に、特に、各赤外線検出器が互いに検出する重複検出エリアにある物体を精度良く、正確に検出する信頼性の高い物体検出装置が得られる。

【００９７】また、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生時刻を検出して確定し、また、各出力波形の電圧が基準電圧とそれぞれにクロスする各ゼロクロスを検出し、この検出した各ゼロクロスが各出力波形のどちらか一方で２回発生してゼロクロス間が成立したかどうかを判別し、この判別結果より、判別条件が成立したときは、この成立したゼロクロス間での各出力波形の極大・極小の符号差から各出力波形の一致度を判定し、この判定した出力に基づいて物体の位置を判別するので、この各波形のどちらか一方で成立したゼロクロス間の時間によって各赤外線検出器間の感度差や取付ズレに起因する出力波形間の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の最も安定して明確になる極大・極小を比較して物体の位置を判定するために、各検出エリア、特に、互いの赤外線検出器が検出する重複検出エリアにある物体を精度良く、正確に検出する信頼性の高い物体検出装置が得られる。

【００９８】また、一部が互いに重複する検出エリアから物体が放射する赤外線をそれぞれに検出し、このそれぞれに検出した各赤外線の出力波形の極大・極小の発生

時刻を検出して確定し、また、各出力波形の電圧が基準電圧とそれぞれにクロスする各ゼロクロスを検出し、この検出した各ゼロクロスが各出力波形のそれぞれで２回発生してゼロクロス間が互いに成立したかどうかを判別し、この判別結果より、判別条件が成立したときは、この互いに成立したそれぞれのゼロクロス間を包括するゼロクロス区間での各出力波形の極大・極小数および同期極性から各出力波形の一致度を判定し、この判定した出力に基づいて物体の位置を判別するので、この互いに成立したゼロクロス区間の時間によって各赤外線検出器間の感度差や取付ズレに起因する出力波形間の位相ズレの誤差を吸収し、この誤差を吸収した各出力波形の最も安定して明確になる各出力波形の極大・極小数よび同期極性の差と設定極大・極小数よび同期極性の波形間基準とを、物体の移動の区切りを示す各出力波形の区切りであるゼロクロス間が互いに成立した後に、比較して物体の位置を判定するために、複数の各検出エリアの物体の位置を精度良く、正確に判定する信頼性の高い物体検出装置が得られる。

【００９９】また、極大極小検出手段が、各赤外線検出器の出力波形の電圧値が予め設定された飽和しきい値幅を越えたとき、この越えた電圧値をピークカットして飽和しきい値幅以内に保持し、この保持を開始してから終了するまでの中間時間で各出力波形に極大・極小が発生したと判断するので、検出不可能な飽和状態の各出力波形の極大・極小も検出できるため、各出力波形の極大極小を精度良く、確実に検出する信頼性の高い物体検出装置が得られる。

【０１００】また、極大極小検出手段が、各赤外線検出器の出力波形の電圧値が予め設定された下限しきい値内に維持される時間が所定時間を越えときは、各出力波形の検出が終了したと判断し、また、出力電圧値が予め設定された下限しきい値幅内に維持される時間が所定時間以内のときは、各出力波形が継続していると判断するので、下限しきい値幅により各出力波形のノイズを除去し、また、所定時間により各赤外線の最終ゆり戻し波形の検出終了を確定し、さらに、下限しきい値幅以内で一時的に不連続になる各赤外線波形を連続しているように検出するために、ノイズによる誤判断を防止し、また、各赤外線の最終ゆり戻し波形による検出未終了の誤情報を防止し、かつ、各出力波形を常に安定した状態で検出する信頼性の高い物体検出装置が得られる。

【０１０１】また、波形一致度判定手段が、各出力波形間のピーク時間差および振幅比から設定したファジールールとメンバーシップ関数に基づいて各領域の人体有無を判定するので、各出力波形間の検出結果を補完し、少ない情報量で各領域の人体有無を精度良く、正確に判定するため、メモリー容量が小さく、小形・軽量化された経済的で、信頼性の高い物体検出装置が得られる。

【０１０２】また、波形一致度判定手段が、判別条件が成立し、この成立したゼロクロス区間での各出力波形の極大極小数および同期極性が同一の時に、このゼロクロス区間の各出力波形の最後の極大極小数および同期極性に基づいて各出力波形の一致度を判定するので、このゼロクロス区間での最後の各出力波形の極大極小数および同期極性のみの少ない検出情報量で物体の位置を判別するために、処理時間が早く、メモリー容量が小さく、小形・軽量化された経済的で、信頼性の高い物体検出装置が得られる。

【０１０３】また、波形成立判別手段が、各出力波形の終了ゼロクロスを回避して各ゼロクロスを判別するので、各赤外線の最終波形で発生するゆり戻し波形のゼロクロス未の誤情報を除去して物体の位置を判別するため、最終ゆり戻し波形によるゼロクロス未の誤情報を防止した信頼性の高い物体検出装置が得られる。

【図面の簡単な説明】

【図１】この発明の実施例１の人体検出装置のブロック構成図の概要。

【図２】この発明の実施例１の各赤外線検出器の出力波形状況図。

【図３】この発明の実施例２の人体検出装置のブロック構成図。

【図４】この発明の実施例２の赤外線検出器の出力波形と波形情報計測保持の様子を示す模式図。

【図５】この発明の実施例２の波形信号の処理手順を示す流れ図。

【図６】この発明の実施例３の赤外線検出器の出力波形が飽和したときの極大極小検出の様子を示す模式図。

【図７】この発明の実施例４のファジー推論の入出力系の説明図。

【図８】この発明の実施例４のファジールールとメンバーシップ関数図。

【図９】この発明の実施例４の出力マップ図。

【図１０】この発明の実施例５の赤外線検出器の出力波形図。

【図１１】この発明の実施例６の赤外線検出器の出力波形図。

【図１２】この発明の実施例７の赤外線検出器の出力波形図。

【図１３】従来の人体検出装置の構成を示すブロック図。

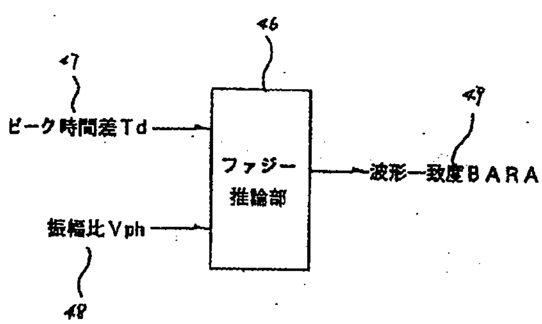
【図１４】従来の人体検出装置の動作を示すタイムチャート。

【符号の説明】

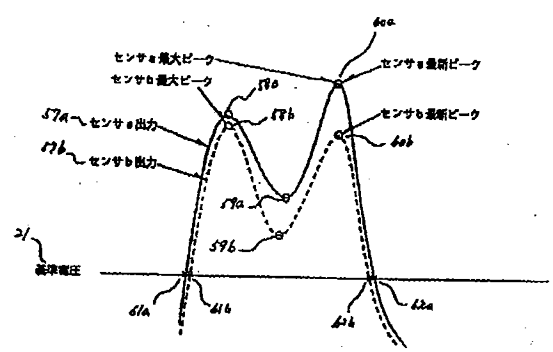
１　検出エリア
１Ａ，１Ｂ　単エリア
１Ｃ　重複エリア
２　赤外線検出器
３　増幅手段
６　信号検出手段

８　ピーク電圧計測保持手段
９　ピーク時刻計測保持手段
１０　波形一致度判定手段
１１　検出エリア判別手段
１２　Ａ／Ｄ変換器
１３　時間遅れ信号検出手段
１４　極大極小発生検出手段
１５　極大極小電圧計測保持手段
１６　極大極小時刻計測保持手段
１７　極大極小計数保持手段
１８　ゼロクロス検出計数手段
１９　波形判定条件成立判別手段
２０　マイコン
２１　基準電圧
２２　赤外線検出器出力波形
２３，２４　信号発生検出しきい電圧
２５　信号発生タイムチャート
２６　時間遅れ信号発生タイムチャート
２７　極大
２８　極大発生時刻
２９　極小
３０　極小発生時刻
３１　極大極小検出タイムチャート
３２　ゼロクロス検出タイムチャート
３３　波形情報収集処理
３４　最大出力可能電圧
３５　最小出力可能電圧
３６　極大飽和検出しきい電圧
３７　極小飽和検出しきい電圧
３８　極大飽和
３９　極大飽和開始時刻
４０　極大飽和終了時刻
４１　極大飽和発生時刻
４２　極小飽和
４３　極小飽和開始時刻
＊４４　極小飽和終了時刻
４５　極小飽和発生時刻
４６　ファジー推論部
４７　ファジー推論入力：ピーク時間差Ｔｄ
４８　ファジー推論入力：振幅比Ｖｐｈ
４９　ファジー推論出力：波形一致度ＢＡＲＡ
５０　ファジールール
５１～５３　ファジーメンバーシップ関数
５４，５５　出力マップ
５６　境界
５７　赤外線検出器出力波形
５８～６０　極大極小（ピーク）
６１，６２　ゼロクロス
６３　赤外線検出器出力波形
６４～６５　極大極小（ピーク）
６６，６７　ゼロクロス
６８　極大極小（ピーク）
６９　ゼロクロス
７０　波形判断回避期間
７１　比較器
７２　アンド回路
７３　判定出力
Ｆ１　信号検出処理
Ｆ２　信号検出による分岐
Ｆ３　極大極小検出処理
Ｆ４　極大極小検出による分岐
Ｆ５　極大極小電圧計測保持処理
Ｆ６　極大極小時刻計測保持処理
Ｆ７　極大極小計数保持処理
Ｆ８　ゼロクロス検出処理
Ｆ９　ゼロクロス検出による分岐
Ｆ１０　ゼロクロス計数保持処理
Ｆ１１　判定条件分岐処理
Ｆ１２　ピーク一致度判定処理
＊　Ｆ１３　検出エリア判別処理

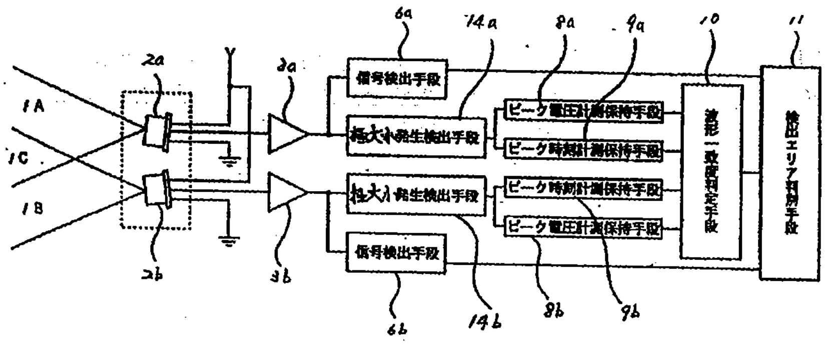
【図７】



【図１０】



【図１】



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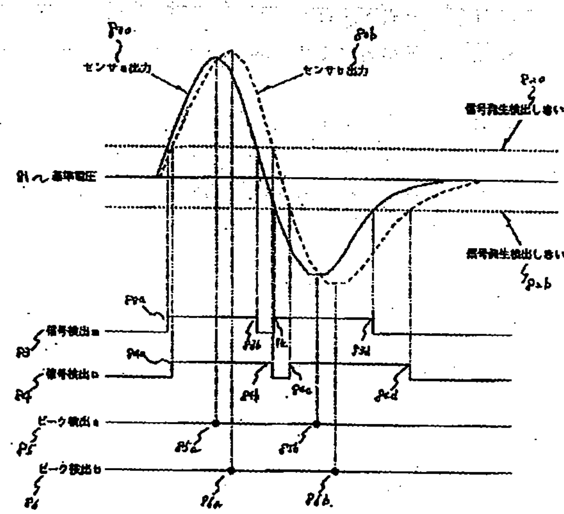

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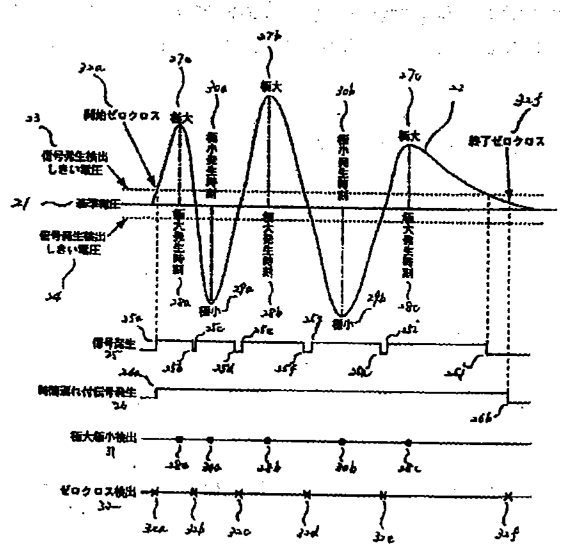
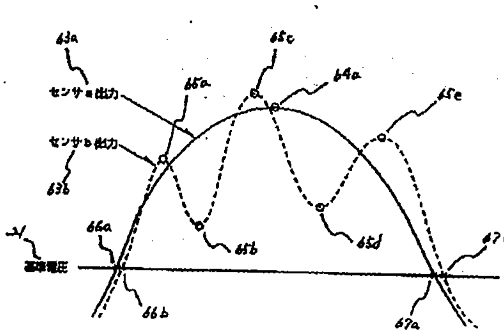
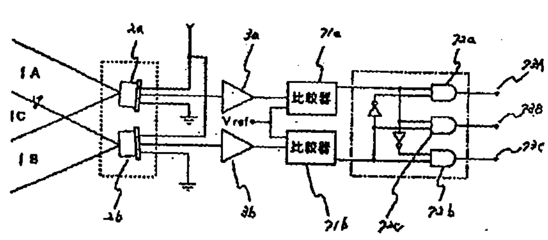


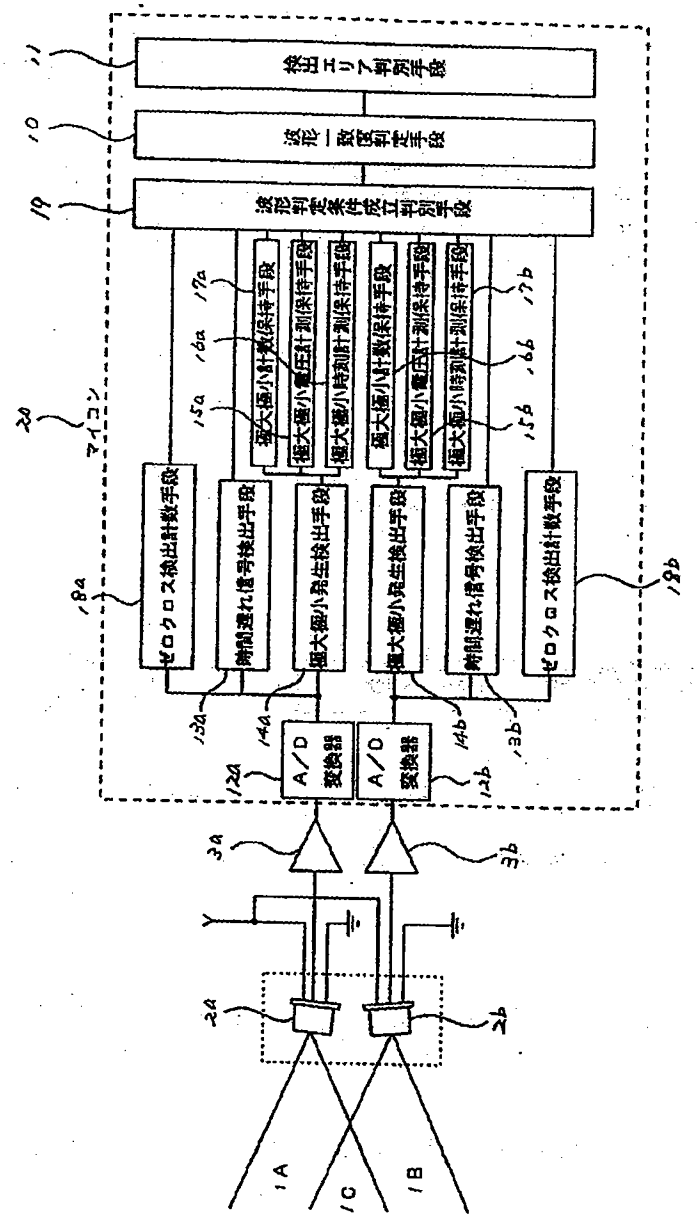
【図１１】



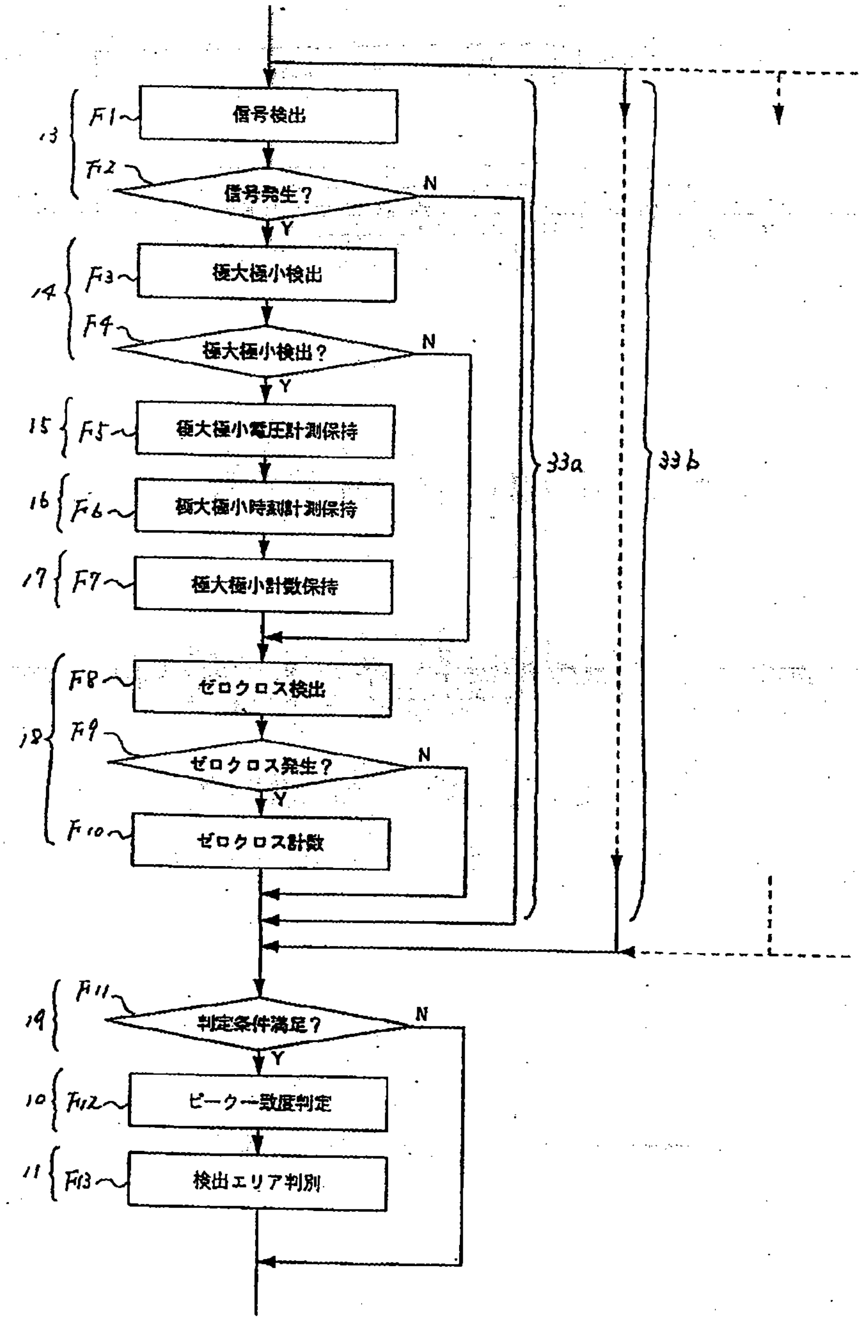
【図１３】



【図3】


検出エリア判別手段
波形一致度判定手段
波形判定条件成立判別手段
極大極小計数保持手段
極大極小電圧計測保持手段
極大極小時刻計測保持手段
ゼロクロス検出計数手段
時間遅れ信号検出手段
極大極小発生検出手段
A／D変換器
マイコン
11
10
19
20
17a
16a
15a
17b
16b
15b
18a
18b
13a
13b
14a
14b
12a
12b
3a
3b
2a
2b
1A
1B
1C

【図5】


信号検出
信号発生？
N
Y
極大極小検出
極大極小検出？
極大極小電圧計測保持
極大極小時刻計測保持
極大極小計数保持
ゼロクロス検出
ゼロクロス発生？
ゼロクロス計数
判定条件満足？
ピーク一致度判定
検出エリア判別
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
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F13
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18
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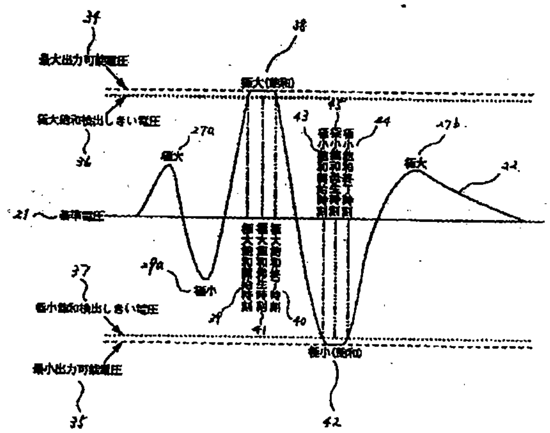
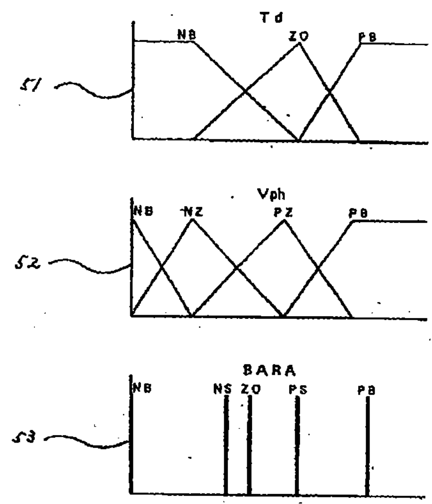
33a
33b

【図６】

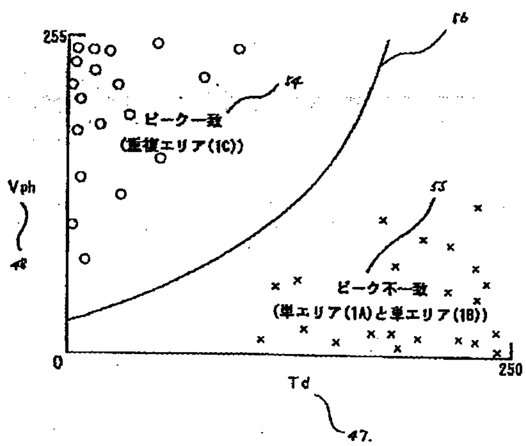


【図８】

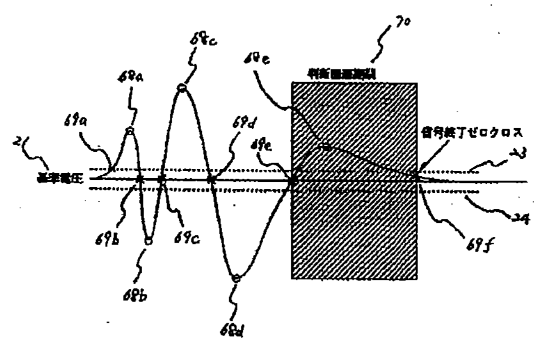
		Td		
		NB	ZO	PB
Vph	NB	NS	NB	NB
	NZ	PS	NS	NB
	PZ	PB	NS	NB
	PB	PB	ZO	NB



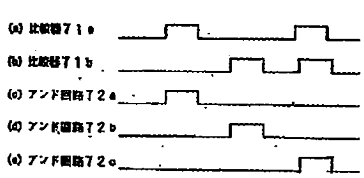
【図９】



【図１２】



【図１４】



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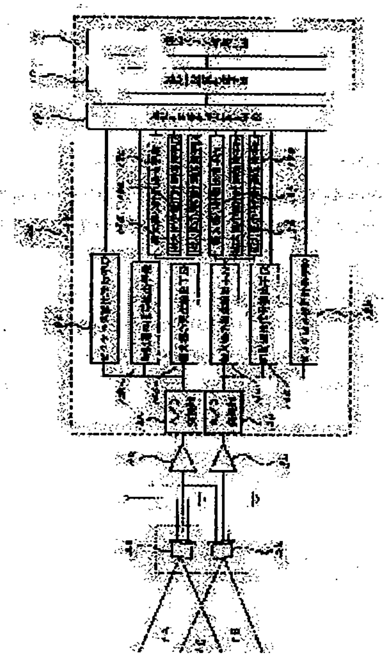
(54) OBJECT DETECTOR

(57)Abstract:
PURPOSE: To obtain a highly reliable object detector for detecting the position of an object accurately and correctly.
CONSTITUTION: Infrared detectors 2a, 2b respectively detect infrared rays radiated from partially overlapped detection areas 1A, 1B and 1C of a human body. The detection results are then compared with a waveform decision criterion. Means 14a, 14b determine the maximal and minimal values of each output waveform based on the decision results and means 19 decides each zero-cross detected by zero-cross detecting means 18a, 18b. When decision conditions are satisfied, means 10 compares the maximal and minimal numbers and the synchronous polarity of each output waveform in the satisfied cross-section with the decision criteria thereof and means 11 decides presence of a human body in each detection area based on the comparison results.



CLAIMS

[Claim(s)]
[Claim 1]A thing which detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually, comprising:

A maximum minimum detection means to detect the generation times of an output wave of each of said infrared detector maximum minimum, and to become final and conclusive.
A detection area discriminating means which distinguishes a position of said object from a time lag of the generation times of each of this settled output wave maximum minimum based on an output of a waveform coincidence degree judging means which judges the degree of coincidence of each output wave, and this waveform coincidence degree judging means.

[Claim 2]A thing which detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually, comprising:
A maximum minimum detection means to detect the maximum and the minimum of an output wave of each of said infrared detector, and to become final and conclusive.
A zero cross detection means to detect each zero cross of each which voltage of each of said output wave crosses at reference voltage and each.
A waveform formation discriminating means which distinguishes whether each of this detected zero cross occurred twice in one of said each output wave, and between zero crosses was materialized.
From a discriminated result of this waveform formation discriminating means, when a discrimination condition is satisfied, A detection area discriminating means which distinguishes a position of said object from the numerals difference of each of said output wave between this materialized zero cross maximum minimum based on an output of a waveform coincidence degree judging means which judges the degree of coincidence of each output wave, and this waveform coincidence degree judging means.

[Claim 3]A thing which detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually, comprising:
A maximum minimum detection means to detect the maximum and the minimum of an output wave of each of said infrared detector, and to become final and conclusive.
A zero cross detection means to detect each zero cross of each which voltage of each of said output wave crosses at reference voltage and each.
A waveform formation discriminating means which distinguishes whether each of this detected zero cross occurred twice in each of each of said output wave, and between zero crosses was materialized mutually.
From a discriminated result of this waveform formation discriminating means, when a discrimination condition is satisfied, A waveform coincidence degree judging means which judges the degree of coincidence with the maximum beforehand set to the maximum of each of said output wave in the zero cross section which includes between each of this zero cross materialized mutually, and a difference of a decimal and synchronous polarity, and a judging standard between waveforms of a decimal and synchronous polarity, [very] [very] A detection area discriminating means which distinguishes a position of said object based on an output of this waveform coincidence degree judging means.

[Claim 4]The object sensing device comprising according to any one of claims 1 to 3:
Saturation voltage holding mechanism which carries out peak shaving of this exceeded pressure value to it, and is held within said saturation threshold width for it when a pressure value of an output wave of each of said infrared detector exceeds saturation threshold width set up beforehand for said maximum minimum detection means.
A saturation peak decision means judged that the maximum and the minimum occurred in said each output wave in middle time after this saturation voltage holding mechanism starts maintenance until it ends.

[Claim 5]When time maintained in minimum threshold width by which a pressure value of an output wave of each of said infrared detector was beforehand set as said maximum minimum detection means exceeds predetermined time, When time maintained in minimum threshold width to which it judged that said each output wave was completed, and said output voltage value was set beforehand is less than predetermined time, The object sensing device according to any one of claims 1 to 4 provided with a time lag detection means to judge that said each output wave is continuing.
[Claim 6]The object sensing device according to any one of claims 1 to 5, wherein a waveform coincidence degree judging means judges the degree of coincidence of each output wave based on a fuzzy rule and a membership function which were set up from a peak time difference and a gain between output waves of each infrared detector.

[Claim 7]Said discrimination condition is satisfied by waveform coincidence degree judging means, and when the maximum minimum number of each of said output wave in this materialized zero cross section and synchronous polarity are the same, The object sensing device according to claim 3 judging the degree of coincidence of each output wave based on the maximum minimum number of the last of each of said output wave of this zero cross section, and synchronous polarity.
[Claim 8]Claim 2, wherein a waveform formation discriminating means avoids and distinguishes an end zero cross of each output wave which said zero cross detection means detected, or the object sensing device according to claim 3.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the object sensing device which detects the infrared rays which a heat source object like a human body emits, for example, and detected the existence of the object in detection area.
[0002]
[Description of the Prior Art]Drawing 13 and drawing 14 are the figures showing sensing devices, such as the conventional human body shown in JP,2-134593,A, for example, and the block diagram in which drawing 13 shows the composition of a human body detector, and drawing 14 are time charts which show the operation.
[0003]In addition in a figure, the inside 1C of detection area of 1A-1C is an infrared detector as for which infrared detection area, 2a, and 2b detect infrared rays from the detection area 1A-1C, and detection area which 2b overlaps with the infrared detector 2a, and is detected. The amplifying means in which 3a and 3b amplify the output signal of an infrared detector, The comparator which binary-izes the signal with which 71a and 71b were amplified as compared with a standard, and 72a-72c are AND circuits which distinguish and output whether there was any movement of a human body from the signal combination of the comparators 71a and 71b in which detection area 1A-1C.
[0004]When the conventional human body detector is constituted as mentioned above, for example, there is movement of the heat source of a human body etc. only in the detection area 1A, the infrared change from the detection area 1A is limited only to the infrared detector 2a, and is condensed, and the output signal of the infrared detector 2a is changed. This output signal is amplified, is binary-ized by the comparator 71a, and turns into H signal which shows movement. On the other hand, since there is no change of infrared rays in the detection area 1B and 1C, the output of infrared-detector 2b does not change but the comparator 71b serves as as [L signal which does not show movement]. Thus, the output from the comparators 71a and 71b is combined, and when AND circuit 72a is H signal and AND circuits 72b and 72c are the outputs of L signal, it is judged that the human body moved in the detection area 1A.
[0005]Like this, when a human body moves only in the detection area 1B, as for the comparator 71a, L signal and the comparator 71b serve as H signal, AND circuits 72a and 72c serve as L signal, and AND circuit 72b serves as H signal. When movement of a human body is only the duplication detection area 1C, both the comparators 71a and 71b serve as H signal, AND circuits 72a and 72b serve as L signal, AND circuit 72c serves as H signal, and it is judged that the human body moved in the detection area of

1C. Since both the comparators 71a and 71b serve as H signal when there is human body movement simultaneously in the position of the detection area 1A and the detection area 1B, all AND circuits serve as H signal, and will output the same signal with the human body having moved in the duplication detection area of 1C.

[0006]Even if there is phase difference of the output signal resulting from setting-out gap of the detection area by the sensitivity differences of each detector or attachment gap of each detector etc., each comparator, The output signal detected in the real time from each infrared detector is binary-ized, H as it is or L signal is outputted, and an AND circuit distinguishes the detection area where the human body moved based on this output signal. Therefore, as being shown in drawing 14, even when there is movement of a human body only in the duplication detection area 1C, In the range from which the phase of the output signal which originates in the sensitivity differences between each infrared detector, attachment gap, etc., and is produced shifted. Since the output signal from infrared-detector 2b does not change and H signal and L signal from the comparator 71b are outputted from the comparator 71a, AND circuit 72a is H signal, and it is judged that the human body moved [at them] in the detection area 1A since AND circuits 72b and 72c served as L signal. However, in the range in which whose phase difference of the output signal time passed and was lost. Since the output signal from infrared-detector 2b changes, H signal is outputted from the comparators 71a and 71b, and AND circuits 72a and 72b judge that the human body moved [at them] in the detection area 1C since L signal and AND circuit 72c served as H signal by **.

[0007]

[Problem(s) to be Solved by the Invention]According to the conventional object sensing device, to unstable timing which is mentioned later, detect each output wave and, moreover, as explained above The detection sensitivity difference between each infrared detector, Or in order for real time to compare each output wave, without absorbing the phase difference of the output signal which originates in the difference of the movement speed of a human body, and the detection speed of each infrared detector, the attachment gap between each infrared detector, etc., and is produced and to judge nothing [human-body-presence] of each detection area, It is accurate and nothing [human-body-presence] of each detection area cannot be distinguished correctly. There was a problem that nothing [human-body-presence] in the duplication detection area where each infrared detector superimposes and detects infrared rays especially could not distinguish correctly. Since the above detection results that were unstable and moreover phase difference was included are compared with an inaccurate distinction standard and nothing [human-body-presence] of two or more detection area of each is distinguished from this comparison result, Although an incorrect judgment was not made and people were not conversely unless there were people, although people were needed when people were in two or more detection area of each especially, respectively, when there were people, an incorrect judgment was made and there was a problem that nothing [human-body-presence] of two or more detection area of each could not distinguish correctly.

[0008]It is what was made in order that this invention might solve the above problems, Each output wave is detected to the timing which the output wave of each infrared rays which determines nothing [human-body-presence] of each detection area (each detection area) is stabilized most, and becomes clear, Compare each output wave which absorbed the error of the phase difference of the output signal resulting from the sensitivity differences between each infrared detector, attachment gap, etc., and And nothing [human-body-presence] of each detection area, In particular, each infrared detector aims at providing a human body detector with high reliability which it is accurate and distinguishes correctly nothing [human-body-presence] of a duplication detection area that superimposes and detects infrared rays. The maximum and the minimum number of each output wave, and synchronous polarity which absorbed the error of the phase difference of the output signal which detects each output wave to the timing which is stabilized most and becomes clear, originates in the sensitivity differences between each infrared detector, attachment gap, etc., and is produced, the maximum, and the waveform distinction standard of a decimal and synchronous polarity, [very] A pause of each output wave which shows a pause of human body movement aims at providing a human body detector with high reliability which it is accurate and distinguishes correctly nothing [human-body-presence] of two or more detection areas of each as compared with whenever [which is materialized mutually].

[0009]

[Means for Solving the Problem]In what detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually in a human body detector concerning this invention, A maximum minimum detection means to detect the

generation times of an output wave of each of said.infrared detector maximum minimum, and to become final and conclusive, It has a waveform coincidence degree judging means which judges the degree of coincidence of each output wave from a time lag of the generation times of each of this settled output wave maximum minimum, and a detection area discriminating means which distinguishes a position of said object based on an output of this waveform coincidence degree judging means.
[0010]In what detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually, A maximum minimum detection means to detect the maximum and the minimum of an output wave of each of said infrared detector, and to become final and conclusive, A zero cross detection means to detect each zero cross of each which voltage of each of said output wave crosses at reference voltage and each, A waveform formation discriminating means which distinguishes whether each of this detected zero cross occurred twice in one of said each output wave, and between zero crosses was materialized, From a discriminated result of this waveform formation discriminating means, when a discrimination condition is satisfied, It has a waveform coincidence degree judging means which judges the degree of coincidence of each output wave from the numerals difference of each of said output wave between this materialized zero cross maximum minimum, and a detection area discriminating means which distinguishes a position of said object based on an output of this waveform coincidence degree judging means.
[0011]In what detected to each infrared rays which an object emits with each at least two or more infrared detectors which have the detection area where a part overlaps mutually, A maximum minimum detection means to detect the maximum and the minimum of an output wave of each of said infrared detector, and to become final and conclusive, A zero cross detection means to detect each zero cross of each which voltage of each of said output wave crosses at reference voltage and each, A waveform formation discriminating means which distinguishes whether each of this detected zero cross occurred twice in each of each of said output wave, and between zero crosses was materialized mutually, From a discriminated result of this waveform formation discriminating means, when a discrimination condition is satisfied, A waveform coincidence degree judging means which judges the degree of coincidence with the maximum beforehand set to the maximum of each of said output wave in the zero cross section which includes between each of this zero cross materialized mutually, and a difference of a decimal and synchronous polarity, and a judging standard between waveforms of a decimal and synchronous polarity, [very] [very] It has a detection area discriminating means which distinguishes a position of said object based on an output of this waveform coincidence degree judging means.
[0012]When a pressure value of an output wave of each of said infrared detector exceeds saturation threshold width set up beforehand for said maximum minimum detection means, It has saturation voltage holding mechanism which carries out peak shaving of this exceeded pressure value, and is held within said saturation threshold width, and a saturation peak decision means judged that the maximum and the minimum occurred in said each output wave in middle time after this saturation voltage holding mechanism starts maintenance until it ends.
[0013]When time maintained in minimum threshold width by which a pressure value of an output wave of each of said infrared detector was beforehand set as said maximum minimum detection means exceeds predetermined time, It judges that said each output wave was completed, and when time maintained in minimum threshold width to which said output voltage value was set beforehand is less than predetermined time, it has a time lag detection means to judge that said each output wave is continuing.

[0014]A waveform coincidence degree judging means judges the degree of coincidence of each output wave based on a fuzzy rule and a membership function which were set up from a peak time difference and a gain between output waves of each infrared detector.
[0015]Said discrimination condition is satisfied by waveform coincidence degree judging means, and when the maximum minimum number of each of said output wave in this materialized zero cross section and synchronous polarity are the same, based on the maximum minimum number of the last of each of said output wave of this zero cross section, and synchronous polarity, the degree of coincidence of each output wave is judged. [0016]A waveform formation discriminating means avoids and distinguishes an end zero cross of an output wave of each infrared detector which said zero cross detection means detected.
[0017]
[Function]In the object sensing device constituted as mentioned above, The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, The generation times of the output wave of each infrared rays detected to this each maximum minimum are

detected, and it becomes final and conclusive, the degree of coincidence of each output wave is judged from the time lag of the generation times of each of this settled output wave maximum minimum, and an objective position is distinguished based on this judged output. [0018]The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, Detect the generation times of the output wave of each infrared rays detected to this each maximum minimum, and it becomes final and conclusive, Each zero cross which the voltage of each output wave crosses at reference voltage and each is detected, When it distinguishes whether each of this detected zero cross occurred twice in one of each output wave, and between zero crosses was materialized and a discrimination condition is satisfied from this discriminated result, The degree of coincidence of each output wave is judged from the numerals difference of each output wave between this materialized zero cross maximum minimum, and an objective position is distinguished based on this judged output. [0019] The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, Detect the generation times of the output wave of each infrared rays detected to this each maximum minimum, and it becomes final and conclusive, Each zero cross which the voltage of each output wave crosses at reference voltage and each is detected, When it distinguishes whether each of this detected zero cross occurred twice in each of each output wave, and between zero crosses was materialized mutually and a discrimination condition is satisfied from this discriminated result, The degree of coincidence with the maximum beforehand set to the maximum in the zero cross section which includes between each of this zero cross materialized mutually, and the difference of a decimal and synchronous polarity, and the judging standard between waveforms of a decimal and synchronous polarity is judged, and an objective position is distinguished based on this judged output. [very] [very]

[0020]When the maximum minimum detection means exceeds the saturation threshold width to which the pressure value of the output wave of each infrared detector was set beforehand, Peak shaving of this exceeded pressure value is carried out, it holds within saturation threshold width, and it is judged that the maximum and the minimum occurred in each output wave in middle time after starting this maintenance until it ends.
[0021]When the time when the maximum minimum detection means is maintained in the minimum threshold to which the pressure value of the output wave of each infrared detector was set beforehand exceeds predetermined time, When the time maintained in the minimum threshold width to which it judged that detection of each infrared waveform was completed, and the output voltage value was set beforehand is less than predetermined time, it is judged that each output wave is continuing.
[0022]A waveform coincidence degree judging means judges the degree of coincidence of each output wave based on the fuzzy rule and membership function which were set up from the peak time difference and gain between the output waves of each infrared detector.
[0023]A discrimination condition is satisfied by the waveform coincidence degree judging means, and when the maximum minimum number of each output wave in this materialized zero cross section and synchronous polarity are the same, based on the maximum minimum number of the last of each output wave of this zero cross section, and synchronous polarity, the degree of coincidence of each output wave is judged. [0024]A waveform formation discriminating means avoids the end zero cross of the output wave of each infrared detector, and distinguishes each zero cross.
[0025]
[Example]
Example 1. drawing 1 - drawing 2 are the figures showing one example of this invention, drawing 1 is a block lineblock diagram of the human body detector of Example 1, and drawing 2 is an output wave figure of each infrared detector of Example 1. Drawing 4 is a flow chart showing the procedure of the waveform signal which each infrared detector detects, and drawing 12 shows the output wave situation between the waveforms which each infrared detector outputted. Identical codes show the same thing as a device conventionally.
[0026]In addition in drawing 1, infrared detection area, 2a, and 2b of 1A-1C are an infrared detector which detects infrared rays, and duplication detection area where the inside 1C of detection area superimposes infrared rays, and the infrared detector 2a and 2b detect it. The amplifying means in which 3a and 3b amplify the output signal of the infrared detector 2a and 2b, and 6a and 6b, The signal detection means which judges whether it has the amplitude more than the minimum threshold width to which the voltage of the output wave which these amplifying means 3a and 3b amplified was set beforehand, and 14a and 14b, A maximum minimum generating detection means to detect based on the waveform judgment standard which mentions the maximum minimum of an infrared output wave later,

and to become final and conclusive the generation times of the maximum minimum of this detected output wave, and 8a and 8b, The peak voltage measurement holding mechanism which carries out measurement maintenance of the pressure value when it is built in the maximum minimum generating detection means 14a and 14b and the maximum minimum of an output wave is detected, and 9a and 9b, The peak time measurement holding mechanism which carries out measurement maintenance of the time when it is built in the maximum minimum generating detection means 14a and 14b and the maximum minimum of an output wave is detected, The waveform coincidence degree judging means which compares the time reference which shows the difference between the output waves by which 10 was beforehand set to the maximum minimum time of each output wave obtained from the pressure value of the maximum minimum of the output wave of each infrared detector, and the information on generation times, 11 is a detection area discriminating means which judges the existence of the human body in each detection area 1A-1C from the comparison result of this waveform coincidence degree judging means 10.

[0027]Operation of the human body detector of Example 1 is explained below. First, each infrared detector 2a and the infrared rays by which 2b is emitted from a human body are detected from each detection area 1A-1C where a part overlaps, respectively, This output wave change of infrared rays and waveform judgment standard (standard which judges time when time when inclination of an output wave changed to plus ->0 -> minus is changed to the maximum time and minus ->0 -> plus to be minimum time) that were detected are compared, The maximum minimum generating detection means 14a and 14b become final and conclusive the time of each output wave maximum minimum from this comparison result. Next, the waveform coincidence degree judging means 10 compares the time reference which shows the difference between the output waves beforehand set to the generation times of each of this settled output wave maximum minimum, Even if the time reference (for example, 1 second) which the peak time maximum minimum was checked from the infrared detector 2a to the output wave, and was beforehand set as it from this checked time passes, When the time maximum minimum is not checked from infrared-detector 2b of another side to a waveform, It judges with those with a human body to the detection area 1A, and even if a setting-out time reference passes since this checked time conversely, when peak time is checked from infrared-detector 2b to a waveform, and the peak time maximum minimum is not checked by the waveform of the infrared detector 2a, it judges with those with a human body to the detection area 1B. When the peak time maximum minimum is checked by the output wave of both each infrared detector 2a and 2b within a setting-out time reference, it judges with those with a human body to the detection area 1C.

[0028]If the time of each waveform maximum minimum is compared and nothing [human-body-presence] is judged as shown in drawing 2, as for the output wave of each infrared rays, in wave steepness, near a reference voltage level, the detection gap between each infrared waveform will become large in **** resin. Since wave steepness becomes loose most, especially the last waveform which shows that movement of a human body stopped, i.e., a **** return waveform, In the conventional sensing device which checks the output wave of each infrared rays on the basis of these since gap of detection between the output waves of each infrared rays becomes increasingly large, since the check of each output wave became unstable vaguely, there was a problem that nothing [human-body-presence] of each area could not be judged correctly. On the other hand, if the time of the peak of the output wave of each infrared rays maximum minimum is detected, since wave steepness changes most rapidly at the time of the maximum and the minimum, it is the clearest, Since it becomes almost fixed as each waveform can be correctly detected in the state where it was stabilized most and the maximum and the minimum time difference between each of this detected waveform are moreover shown in drawing 2, the difference between each output wave becomes more exact.

[0029]When constituting and using with each three or more infrared detectors, it combines one by one for adjoining each mutual infrared detector of every, nothing [human-body-presence] of each [each time it combines] of this detection area is distinguished one by one, and it is made to go, although the above-mentioned explanation described the case where it used combining two infrared detectors.

[0030]As explained above, according to the difference of the maximum and the minimum time difference of each output wave, and setting-out time. The error of the phase difference of each output wave which originates in the sensitivity differences between each infrared detector, attachment gap, etc., and is produced is absorbed, In order to compare the time lag of the generation times maximum minimum which each output wave which absorbed this error is stabilized most, and becomes clear and to judge nothing [human-body-presence] of each detection area, a human body detector with high reliability which it is accurate and distinguishes correctly nothing [human-body-presence] of each detection area and the

especially duplicate detection area is obtained.
[0031]Example 2. drawing 3 – drawing 5 are the figures showing one example of this invention, and drawing 3 is a block lineblock diagram of the human body detector of Example 2.
This drawing 3 adds the time lag signal detection means later mentioned for the means of drawing 1 of Example 1, a zero cross detection means, and a waveform judgment condition formation discriminating means.
A microcomputer realizes the means after the amplifying means of drawing 3. Mimetic diagram drawing 5 which drawing 4 shows the output wave of an infrared detector and the situation of waveform information measurement maintenance is a flow chart showing the procedure of the waveform signal which each infrared detector detects. It is what drawing 3 adds various means to Example 1 of drawing 1, collects information still more finely as above-mentioned, and was made to enable accurate judgment. As for 20 of this drawing 3, an A/D converter, and 13a and 13b a microcomputer, and 12a and 12b A/D converter 12a, Detection is started when the infrared output signal from 12b exceeds minimum threshold width, The time lag signal detection means considered as an end if a signal exceeds a threshold again in the fixed time by which it also goes within minimum threshold width and detection will not be continued and exceeded, and 14a and 14b, A maximum minimum generating detection means to detect the maximum from which inclination of a signal wave form serves as plus ->0 -> minus, and the minimum used as minus ->0 -> plus, When the maximum minimum generating is detected by the maximum minimum generating detection means 14a or 14b as for 15a and 15b, When the maximum minimum generating is detected by the maximum minimum generating detection means 14a or 14b as for the maximum minimum detection holding mechanism which measures and holds the pressure value, and 16a and 16b, the maximum minimum in which the maximum minimum time measurement holding mechanism which measures and holds the generation times, and 17a and 17b calculate and hold the number when the maximum minimum generating is detected by the maximum minimum generating means 14a or 14b — calculation — holding mechanism. 18a and 18b detect generating of the usual zero cross which the bias reference voltage and the signal wave form of a signal intersect, and start / end zero cross at the time of a start and end of a signal wave form, A number means of zero cross detection meters to calculate, and 19 The time lag signal detection means 13a and 13b, Based on the detection information from the maximum minimum generating detection means 14a and 14b and the number means 18a and 18b of zero cross detection meters, a zero cross occurs twice in one of each infrared waveforms, and between zero crosses is a waveform judgment condition formation discriminating means from which only formation distinguishes ** if you please. The waveform coincidence degree judging means 10 here compares the judging standard between waveforms of the maximum minimum beforehand set to the discriminated result of the waveform discriminating means 18a and 18b, and the detection area discriminating means 11 distinguishes nothing [human-body-presence] of each detection area 1A-1C based on this comparison result.
[0032]The bias reference voltage used as the standard which shows that 21 does not have change in the output signal of an infrared detector in drawing 4 when there is no motion of people, An example of the output wave of an infrared detector when people move 22, the signal generation detection threshold upper limit voltage set as voltage with 23 [larger] than the reference voltage 21, The signal generation detection threshold lower limit voltage set as the voltage in which 24 is smaller than the reference voltage 21, and 25 are the time charts which show a signal generation detecting state, . As for 25a, 25c, 25e, 25g, and 25i, an output wave shows the time when the output wave 22 of the infrared detector carried out the detection start of the signal generation exceeding the signal generation detection threshold voltage 23 and 24. 25b, 25d, 25f, 25h, and 25j, When signal generation detection is again started in the fixed time after the end of signal generation detection, the time when an output wave shows the end of detection of signal generation by the output wave 22 of an infrared detector becoming 23 or less than 24 signal generation detection threshold voltage, and 26, Signal detection start time when the time chart of the time lag signal generation detection which detection of signal generation is continuing, and 26a detect generating of a time lag signal, and 26b show signal detection finish time when generating of a time lag signal is detected, respectively. As for outbreak time, and 29a, 29b and 29c, similarly, 27a, 27b, and 27c of the minimum voltage, and 30a, 30b and 30c are [the maximum voltage of the output wave of an infrared detector, and 28a, 28b and 28c / the minimum generation times and 31] the time charts of the maximum minimum detection very much. The start zero cross to which 32 is a time chart of zero cross detection, and 32a makes a signal detection start a zero cross, 32b, 32c, 32d, and 32e show the end [to which the reference voltage 21 and the output wave 22 cross during signal detection] zero cross which usually makes a zero cross a zero cross and 32 f of ends of

signal detection.
[0033]in drawing 5 -- 33a and 33b ... shows the information gathering processing block to the output wave of each infrared detector, and the block of an infrared detector and the same number is required for it. As for 33a and 33b, when processing with a microcomputer, it is common for it not to be processed in parallel but to carry out sequential execution of the processing after [33b] processing of 33a being completed. In drawing 3, the processing block in which F1 - F13 realize each function, 10 and 11, and 13-19 are processing blocks which realize a means to correspond, respectively. Branching and N which processing follows when, as for an arrow, the flow of processing is materialized and, as for Y, conditions are satisfied show branching which processing follows, respectively, when conditions are not satisfied.
[0034]Next, based on the output wave of drawing 4, and the flow chart of drawing 5, the flow of signal processing is explained about the time of there being movement of a human body only in the detection area 1A of drawing 3.
[0035]Since the infrared rays which the infrared detector 2a receives change with movement of the human body which is a far infrared radiator when a human body moves in the detection area 1A, the output wave 22 as shown in drawing 4 occurs, for example. On the other hand, in infrared-detector 2b, since there is no movement of the human body within the detection area 1B or 1C, the infrared rays which infrared-detector 2b receives do not change, but it becomes being about 21 reference voltage bias voltage with as, and an output wave is not changed. Then, let the line which shows the reference voltage 21 be an output wave of infrared-detector 2b for explanation.
[0036]First, the output signal 22 of the infrared detector 2a and the output signal 21 of infrared-detector 2b, i.e., reference voltage, are changed into a digital signal from an analog signal by A/D converters 12a and 12b, respectively. Here, an A/D conversion and signal processing are repeated periodically. That is, they are signal processing after an A/D conversion, and a thing repeated until an A/D conversion and signal processing are stabilized at least again like signal processing after an A/D conversion as for the output wave of an infrared detector.
[0037]Here an A/D conversion from the necessity of distinguishing the degree of coincidence of a waveform peak, Although it is desirable to carry out the A/D conversion of the output wave of each infrared detector in identical time in time, if an A/D conversion can be carried out at an interval short enough to a wave-like change, an effect of the invention will not be barred as distinction of the degree of peak coincidence in identical time.
[0038]Investigation processing of signal generation is branched in the signal detection processing block 13.
[0039]First, in signal detection processing F1, when the value of the output wave digital signal obtained by the A/D conversion becomes 23 or more signal generation reference voltage, or when it becomes 24 or less signal generation reference voltage, a signal generation flag is set. When other, a signal generation flag is reset.
[0040]Subsequently, in F2, when the signal generation flag is set and it is not set to Y, i.e., processing of F3, it branches to N, i.e., processing of F11, respectively. That is, when signal generation is detected, processing of the maximum minimum detection, zero cross detection, etc. is performed, and when signal generation is not detected, processing of the maximum minimum detection, zero cross detection, etc. is not performed.
[0041]In the maximum minimum detection processing block 14, generating of the maximum minimum is investigated and processing is branched.
[0042]First, in the maximum minimum detection processing F3, when inclination of an output wave changes to plus ->0 -> minus and it changes to the maximum and minus ->0 -> plus, the minimum generating flag is set. When other, the maximum minimum generating flag is reset.
[0043]Subsequently, in F4, when the maximum minimum generating flag is set and it is not set to Y, i.e., processing of F5, it branches to N, i.e., processing of F8, respectively. That is, when processing to voltage, time, calculation, etc. is performed when the maximum minimum is detected, and the maximum minimum is not detected, processing to voltage, time, calculation, etc. is not performed.
[0044]In the maximum minimum voltage measurement holding processing block 15 or F5, when judged as the maximum or the minimum, the pressure value is stored in a holding memory.
[0045]In the maximum minimum time measurement holding processing block 16 or F6, when judged as the maximum or the minimum, the time is stored in a holding memory.
[0046]the maximum minimum time -- calculation -- in the holding processing block 17 or F7, when judged as the maximum or the minimum, the total number of the maximum minimum generating within

the judgment period is stored in a holding memory.

[0047]In the zero cross detection processing block 18, generating of a zero cross is investigated and processing is branched.

[0048]In first, the case of a signal detection start in the zero cross detection processing F8. Or when the value of an output wave is size from reference voltage last time and the value of an output wave is below reference voltage this time, Or the value of an output wave is smallness from reference voltage last time, and when the value of the output wave of an output wave is more than reference voltage this time, or in being the end of signal detection, a zero cross generating flag is set, and when other, it resets a zero cross generating flag.

[0049]Subsequently, in F9, when the zero cross generating flag is set and it is not set to Y, i.e., processing of F10, it branches to N, i.e., processing of F11, respectively. That is, when zero cross generating is detected, zero cross counting processing is performed, and when other, processing of zero cross calculation is not performed.

[0050]Information gathering processing blocks 33a and 33b to the output wave of each infrared detector ... After completing processing, by the criteria branching process block 19 and F11, it investigates whether criteria were satisfied and processing is branched.

[0051]When signal detection only of the output wave of one infrared detector is carried out and a zero cross occurs twice in F11, When signal detection of the output wave of two or more infrared detectors is carried out and a zero cross occurs twice [at least] or more in the either, when other, it branches to Y, i.e., processing of F12, to processing of N. That is, when satisfied with the either of the criteria said that at least 2 times or more of zero crosses have occurred, processing of a peak coincidence degree judging, detection area distinction, etc. is performed, and when other, processing of a peak coincidence degree judging, detection area distinction, etc. is not performed.

[0052]Namely, in the blockF12 of ten which the waveform coincidence degree judging means 10 processes. From the maximum minimum pressure value which the signal of an output wave is detected from each infrared detector, for example, is held for every infrared detector, and the information on generation times. When the infrared detector 2a and 2b detect the maximum of an output wave mutually between the materialized zero crosses, Based on the judging standard between waveforms, it judges with each infrared detector 2a and 2b being the same as the output wave of human body movement in the duplication detection area 1C detected mutually, When the maximum differs from the minimum of each output wave mutually, based on the judging standard between waveforms, it judges with it being the same as the output wave of human body movement in the infrared detector 2a of the side which has emitted the Taishin item very much of an output wave, or the single detection area 1A and 1B of 2b detected independently, respectively.

[0053]In the detection area discrimination processing blockF13 of 11. From the decision result obtained with the waveform coincidence degree decision processing block 10, between the materialized zero crosses, when the maximum and the minimum of an output wave are detected only with one infrared detector, It distinguishes that it is human body movement in the maximum of the output wave, and the single detection area of an infrared detector which has emitted the small signal very much, When an output wave signal is detected with two or more infrared detectors and the maximum and the minimum of an output wave are detected mutually, the detection area discriminating means 11 distinguishes that it is human body movement in the duplicate detection area 1C. Subsequently, since initialization of information is performed, the output wave of each infrared detector 2a and 2b is again incorporated with each A/D converter, and whenever a human body moves, the information about to which detection area it moved every can be acquired by continuing and repeating the same processing.

[0054]When constituting and using with each three or more infrared detectors, it combines one by one for adjoining each mutual infrared detector of every, nothing [human-body-presence] of each [each time it combines] of this detection area is distinguished one by one, and it is made to go, although the above-mentioned explanation described the case where it used combining two infrared detectors.

[0055]In this example, a zero cross always absorbs the error of the phase difference of each output wave produced by the sensitivity differences between each infrared detector, attachment gap, etc. by between the zero crosses which occurred twice [at least] or more and were materialized by either as explained above, In order to compare the maximum and the minimum which each output wave which absorbed this error is stabilized most, and becomes clear and to distinguish nothing [human-body-presence] of each detection area, It is accurate, and nothing [human-body-presence] of each detection area is judged correctly, and a human body detector with high reliability which detects correctly nothing [human-body-presence] of the duplication detection area which each infrared

detector detects mutually especially is obtained.

[0056]Example 3. drawing 6 is a figure showing one example of further others of this invention, and is a mimetic diagram showing the situation of the maximum minimum detection when the output wave of an infrared detector is saturated.

[0057]In drawing 6, 21 reference voltage and 22 the output wave of an infrared detector, and 34 The maximum output possible voltage of an amplifying circuit, The minimum output possible voltage of an amplifying circuit and 36 35 The maximum saturation detection threshold voltage, The maximum with which the minimum saturation detection threshold voltage, and 27a and 27b are not saturated 37, The minimum whose maximum saturation finish time and 41 the maximum saturation start time and 40 are saturated the maximum saturated 38 and 39, and are not saturated as for the maximum saturation time and 29a, the minimum saturated 42, and 43 show the minimum saturation start time, 44 shows the minimum saturation finish time, and 45 shows the minimum saturation generation times, respectively.

[0058]Operation of this invention when the saturated maximum minimum occurs based on drawing 6 is explained.

[0059]With a certain infrared detector, when the output wave 22 like drawing 6 occurs, as shown in Example 1, the maximums 27a and 27b and the minimum 29a which have not been saturated detect generating of the maximum minimum from change of inclination of an output wave, process the information by each processing block, and carry out measurement maintenance.

[0060]However, in a actual general amplifying circuit, the voltage range in which an output is possible is restricted by the power supply voltage of the operational amplifier, if an input is large, output voltage will reach the output limit voltage of an operational amplifier, and the saturation which continues outputting voltage under pulse condition will occur. Therefore, since the state of the inclination 0 of an output wave carries out fixed time continuation when the saturated maximum 38 or the saturated minimum 42 occurs, by the same method as the method of detecting the maximum minimum which has not been saturated, detection of required waveform information will not be able to be performed in many cases, and detection area discriminating precision will fall.

[0061]Then, a somewhat larger pressure value than the maximum saturation detection threshold voltage 36 and the minimum output possible voltage 35 is set up for a pressure value somewhat smaller than the maximum output possible voltage 34 as the minimum saturation detection threshold voltage 37, The case where an output wave becomes a 36 or more maximum saturation detection threshold voltage pressure value is considered as the maximum saturation 38, and it detects in distinction from the maximum minimum which has not been saturated by considering the case where it becomes a 37 or less minimum saturation detection threshold voltage pressure value as the minimum saturation 42.

[0062]Subsequently, when the maximum saturation occurs, the maximum saturation start time 39 and the maximum saturation finish time 40 are held and the end of the maximum saturation is carried out, Make the maximum saturation voltage into the maximum saturation detection threshold voltage 36, and at the maximum saturation time 41 of the intermediate time of the maximum saturation start time 39 and the maximum saturation finish time 40. When the maximum minimum detection means 14a and 14b judge that the maximum occurred, and the minimum saturation occurs, the minimum saturation start time 43 and the minimum saturation finish time 44 are held and the end of the minimum saturation is carried out, The minimum saturation voltage is made into the minimum saturation detection threshold voltage 37, and it is judged that the minimum occurred at the minimum saturation time 45 of the intermediate time of the minimum saturation start time 43 and the minimum saturation finish time 44. The operation after this is as Example 2 having explained.

[0063]Example 4. drawing 7 - drawing 9 are the figures explaining the example of further others of this invention.

The figure and drawing 9 which drawing 7 shows the explanatory view of an input-and-output system of fuzzy reasoning, and drawing 8 shows a fuzzy rule and a membership function are an output map figure.

[0064]As for 46, in drawing 7, the input of the fuzzy reasoning part 46 and 49 are outputs a fuzzy reasoning part, and 47 and 48.

[0065]In drawing 8, the rule of a fuzzy reasoning part for 50 to ask for the degree of peak coincidence, and 51-53 are the membership functions of fuzzy reasoning, and, as for 52 of the peak time difference Td, 53 of the gain Vph express the membership function of the degree BARA of peak coincidence 51, respectively.

[0066]In drawing 9, 54 and 55 are the output maps drawn with the rule and membership function of drawing 8, and 56 expresses the boundary.

[0067]Next, operation of this example is explained based on drawing 7.
[0068]It is possible to use the table reference method and fuzzy reasoning which give data on a table beforehand as a means to realize for the waveform coincidence degree judging means 10 of the peak in Example 1 and Example 2 to replace etc. In the table reference method, when resolution may be coarse, it is suitable, but if you are going to make it make a fine judgment, it must have a vast quantity of tables, and is not realistic. On the other hand, since fuzzy reasoning can be used also as an interpolation means which fills between data and data, it can obtain fine resolution easily. The design of fuzzy reasoning, a rule, and a membership function is also easy, and it has an advantage which is very easy to use.
[0069]First, when the output wave of the actual infrared detector was mapped from the data of the peak time difference Td and the gain Vph, respectively, it came to be shown in drawing 9, and the boundary line 56 can separate clearly. Then, the fuzzy rule 50 and the membership functions 51-53 are created based on this figure. This is given to a fuzzy reasoning part.
[0070]Even when the peak time differences Td and the gains Vph by human body movement other than the data shown in drawing 9 are inputted now, the degree of peak coincidence is outputted by the fuzzy interpolation effect. Here, it is outputted for the integer of 0-255, and 0-130 express peak disagreement and 131-255 express peak coincidence.
[0071]Thus, the input of the portion which the rule and membership function for performing a fine judgment can be done simply, and it does not have as data even from little sample data if fuzzy reasoning is used is also received, An exact output can be obtained and, moreover, a design has the feature of it being dramatically easy and being easy to use.
[0072]Example 5. drawing 10 is an output wave figure in the example of further others of this invention, and the output wave of each infrared detector satisfies the criteria of having carried out the zero cross twice [at least] or more mutually, and it expresses at the time of [a part of] two or more same peaks synchronizing and generating. Such a waveform is generated when movement of the human body which goes in and out to duplication detection area is repeated for a short time.
[0073]In drawing 10, 57a reference voltage 21 the output wave of the infrared detector 2a, As for 57b, 58a, 59a, and 60a the output wave of infrared-detector 2b the peak (the maximum minimum) of the output wave of the infrared detector 2a, 58b, 59b, and 60b show the peak (the maximum minimum) of the output wave of infrared-detector 2b, 61a and 62a show the zero crossing point of the output wave of the infrared detector 2a, and 61b and 62b show the zero crossing point of the output wave of infrared-detector 2b, respectively. In this drawing 10, it is the same 60a as the maximum peak of the output wave of the infrared detector 2a, and the newest peak, and the maximum peak of the output wave of infrared-detector 2b is 58b, and the newest peak is 60b.
[0074]Next, operation of this example is explained based on drawing 10.
[0075]First, the zero cross 61a of the infrared detector 2a occurs and ranks second, and the zero cross 61b of infrared-detector 2b occurs. Next, the peak 58a of the infrared detector 2a and the peak 58b of infrared-detector 2b occur almost simultaneous. At this time, measurement maintenance of each voltage and generation times of a peak is carried out, and the number of peaks is calculated. At this time, each infrared detector of the number of peaks is 1. Subsequently, the information on the peaks 59a, 59b, 60a, and 60b of the output wave of each infrared detector is acquired one by one. And the zero cross 62b of infrared-detector 2b occurs and ranks second, and the zero cross 62a of the output wave of the infrared detector 2a occurs. When the zero cross 62a occurred and the output wave of each infrared detector fulfills the criteria that the zero cross occurred twice [at least] or more mutually, and between each-other zero crosses was materialized, processing of a waveform judgment is performed.
[0076]Next, as waveform judgment processing, first, since the judging period 61a - the peak occurrences in 62a are the same, it judges with the peak having been in agreement. If it judges in the groups of all the peak among the peaks generated at this time, the peak information storing memory corresponding to the number of peaks is needed, and since processing is repeated several peak minutes, processing time will also start for a long time. Then, if it is made to judge in the pressure value and the generation times of the newest peak, a memory can be lessened and processing time can also be shortened. Even if it judges in the group of all the peaks and judges the movement zone of a human body in the last pressure value and generation times of a peak in time, eventually, It is more efficient to perform the judgment of the degree of peak coincidence using the pressure value and the generation times of the newest peak, since the decision result by the last peak becomes effective in time.
[0077]Therefore, in peak information collection processing, it is good to establish the peak information holding mechanism (not shown) which updates the newest pressure value and generation times of the

peak one by one in the waveform coincidence degree judging means 10.
[0078]Example 6. drawing 11 is a wave form chart when the output wave of each infrared detector of the example of further others of this invention satisfies the criteria that carried out the zero cross twice [at least] or more mutually, and between zero crosses was materialized mutually.
[0079]In drawing 11, 63a reference voltage 21 the output wave of the infrared detector 2a, As for 63b, 64a the output wave of infrared-detector 2b the peak (the maximum minimum) of the output wave of the infrared detector 2a, 65a, 65b, 65c, 65d, and 65e show the peak (the maximum minimum) of the output wave of the infrared detector 2a, 66a and 67a show the zero crossing point of the output wave of the infrared detector 2a, and 66b and 67b show the zero crossing point of the output wave of infrared-detector 2b, respectively.
[0080]Next, operation of this example is explained with reference to drawing 11. Although operation as described below is carried out, since other means operations are as Example 2 having explained, the waveform judgment condition formation discriminating means 19, the waveform coincidence degree judging means 10, and the detection area discriminating means 11 of this example omit explanation of other operations.
[0081]First, the zero cross 66a of the output wave of the infrared detector 2a occurs and ranks second, and the zero cross 66b of infrared-detector 2b occurs. Next, the peak 65a of the output wave of infrared-detector 2b occurs, a pressure value and generation times are measured, peak occurrences are calculated, and the hold stores of the peak information are carried out. At this time, the number of peaks of the output wave of 0 and infrared-detector 2b of the number of peaks of the output wave of the infrared detector 2a is 1. Subsequently, the information on the peaks 65a, 65c, 64a, 65d, and 65e of the output wave of each infrared detector is acquired one by one. And the zero cross 67b of the output wave of the infrared detector 2a occurs and ranks second, and the zero cross 67b of the output wave of infrared-detector 2b occurs. When the zero cross 67b occurred, each infrared detector carries out a zero cross twice [at least] or more mutually, the waveform formation discriminating means 19 distinguishes whether between zero crosses was materialized mutually and a waveform discrimination condition is satisfied. Processing of a waveform judgment is performed in the zero cross section which includes between this zero cross materialized mutually.
[0082]Next, it is a range from the zero cross 66a which is the zero cross section which includes between this zero cross materialized mutually as a waveform judgment, for example to the zero cross 67b, Compare the maximum minimum number which shows the difference between waveforms beforehand set to the maximum minimum number of the output wave of each infrared detector, and synchronous polarity, and the judging standard between waveforms of synchronous polarity, and in this zero cross section materialized mutually. When it is in the situation where the numbers of peaks which the output wave with same synchronous polarity generated, and were detected with each infrared detector 2a and 2b differ, what the human body moved to the duplication area 1C of each infrared detector is conjectured first. Since it had become a waveform which, on the other hand, has two or more small peaks in the output wave of infrared-detector 2b, this had human body movement also in area other than the above-mentioned duplication area 1C. That is, the waveform coincidence degree judging means 10 surmises that there was human body movement also in the single area 1B from there being many peaks of infrared-detector 2b. In the above-mentioned criteria situation, when there are many peaks of the infrared detector 2a, it is surmised that there was human body movement in the duplication area 1C and the single area 1A. When the number of peaks which the same [synchronous polarity] and each infrared detector 2a, and 2b detected is the same, it is surmised that it is movement of the human body in the duplication area 1C. When the number of peaks which the output wave from which synchronous polarity differs generated, and each infrared detector 2a and 2b detected is the same, it is surmised that there was movement of a human body by each of the single area 1A and 1B.
[0083]Therefore, waveform judgment conditions are satisfied, and when two or more infrared detectors 2a of each differ from the number of peaks of the output wave which 2b detected, the detection area discriminating means 11 distinguishes that it is human body movement in both duplication area and the single area by the side of the infrared detector which has detected many numbers of peaks. When the number of peaks which the output wave from which synchronous polarity differs generated, and each infrared detector 2a and 2b detected is the same, it distinguishes that there was movement of a human body by each of the single area 1A and 1B.
[0084]When constituting and using with each three or more infrared detectors, it combines one by one for adjoining each mutual infrared detector of every, nothing [human-body-presence] of each [each time it combines] of this detection area is distinguished one by one, and it is made to go, although the

above-mentioned explanation described the case where it used combining two infrared detectors.
[0085]The inside of the zero cross section which includes between the zero crosses materialized mutually as explained above, Namely, whenever a pause of the output wave which shows a pause of movement of a human body is materialized mutually, The error of the phase difference of each output wave produced by the sensitivity differences between each infrared detector, attachment gap, etc. is absorbed by this materialized zero cross section, In order to compare and judge the maximum minimum number beforehand set to the maximum-minimum number of each output wave and synchronous polarity which absorbed this error, and which each output wave is stabilized most and become clear, and the judging standard between waveforms of synchronous polarity, The judgment resolution of a device improves, it is accurate and human body movement of two or more detection area in human body movement in each detection area 1A and 1C, human body movement in each detection area 1B and 1C, or each detection area 1A and 1B is distinguished correctly.
[0086]Example 7. drawing 12 is a figure showing the example of further others of this invention, and shows the output wave of a common infrared detector.
[0087]In drawing 12, 23 and 24 reference voltage 21 signal generation detection threshold voltage, 68a, 68b, 68c, 68d, and 68e express the period which avoids the zero crossing point of an output wave 69a, 69b, 69c, 69d, 69e, and 69f, and avoids 69 f of end zero crossing points and when especially 70 avoids a waveform judgment for the peak (the maximum minimum) of an output wave, respectively.
[0088]Next, operation of this Example 7 is explained with reference to drawing 12.
[0089]First, if the output wave of an infrared detector changes with human body movements and signal generation threshold voltage is exceeded, signal generation detection will be carried out by signal generation detection processing, and the start zero cross 69a will be detected. Subsequently, the peak of the output wave of 68a is detected and measurement maintenance of the peak information is carried out. Next, the zero crossing point of the output wave of 69b is detected. If criteria are satisfied at this time, according to the acquired information, processing of a peak coincidence degree judging, detection area distinction, etc. will be performed. Processing of processing of signal detection, peak detection, zero cross detection, etc. and a waveform judgment, detection area distinction, etc. is performed one by one below. And 69 f of end zero crossing points are detected, signal detection is completed, and a human body movement zone is distinguished.
[0090]However, even an end zero cross is a waveform produced when the waveform between a zero cross (69e) and the front end zero cross 69f carries out band pass amplification of the output of an infrared detector as mentioned above.
Here, it will be called a **** return waveform.
This Yuri return waveform was understood that detecting accuracy falls by experiment, when the detection area which had human body movement using the information on a **** return waveform was distinguished, since many time lag ingredients of an amplifier were originally contained in addition to the print-out of an infrared detector.
[0091]Then, when the zero cross of the output wave of the infrared detector which criteria were satisfied and fulfilled this condition is an end zero cross, If the information on the waveform between the zero cross 69e and the end zero cross 69f in front of [of an end zero cross] one, i.e., a **** return waveform, is disregarded and the evasion standard of this information is made to reflect in a waveform distinction standard, This evasion standard is considered and the waveform condition formation discriminating means 19 comes to distinguish the formation conditions of the zero cross of each output wave.
[0092]Even if the output voltage value of each output wave which is example 8. and which each infrared detector detected for the maximum minimum detection means 14a and 14b of Example 2 exceeds predetermined time in the minimum threshold width set up beforehand, when being maintained, When it judges that each output wave was completed and an output voltage value is maintained within predetermined time in the minimum threshold width set up beforehand, Time lag detection means 13a and 13b to judge that each output wave is continuing are added, If it is made for the maximum minimum detection means 14a and 14b to become final and conclusive the maximum minimum of each output wave based on the decision result of the time lag detection means 3a and 13b, the maximum minimum detection means, Even if the output voltage value of each output wave exceeds predetermined time in the minimum threshold set up beforehand, when being maintained, When maintained within predetermined time in the minimum threshold width to which it judged that each output wave was completed, and the output voltage value was set beforehand, after judging that each output wave is continuing, it comes to shift to the next operation. Since Example 2 explains, the operation after this is

omitted.
[0093]Therefore, become final and conclusive the end of detection of the Yuri return waveform which removes the noise of each output wave with minimum threshold width, and is generated in the last waveform of each infrared rays by predetermined time, and. In order to detect as each output wave which becomes discontinuity within minimum threshold width temporarily is continued, A human body detector with high reliability detected by the stable state which prevented the incorrect judgment by a noise, prevented detection the erroneous information which is not ended according to the last Yuri return waveform of each output wave, and continued each output wave is obtained.
[0094]If this Example 8 and Example 6 are combined, even if there is always no signal of the mutual output wave from each infrared detector 2a and 2b, Even if the pressure value of the output wave of the infrared detector of how which a signal twists exceeds predetermined time in the minimum threshold set up beforehand, when being maintained, The maximum minimum detection means 14a and 14b of Example 8 judge that the output wave from the infrared detector of how which a signal twists was completed, Since an end zero cross is materialized and between zero crosses is always materialized by this end zero cross and start zero cross that were materialized, nothing [human-body-presence] of each detection area will be determined by each waveform characteristic between zero crosses of only the output wave of an infrared detector with another signal. Therefore, it cannot be overemphasized that it also comes to distinguish correctly nothing [human-body-presence] in each singular detection area that was explained in Example 6 besides two or more detection area of each.
[0095]By the way, although the above-mentioned explanation described the case where this invention was used for detection of a human body, it cannot be overemphasized that it can use for detection of an object which emits infrared rays as other heat sources.
[0096]
[Effect of the Invention]In the object sensing device constituted as mentioned above, The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, The generation times of the output wave of each infrared rays detected to this each maximum minimum are detected, And since it becomes final and conclusive, the degree of coincidence of each output wave is judged from the time lag of the generation times of each of this settled output wave maximum minimum and the position of the object of distinction of an objective position is distinguished based on this judged output, By the abrupt change of inclination of each output wave which absorbed the error of the phase difference between each output wave resulting from the sensitivity differences between each infrared detector, or attachment gap, and absorbed this error according to the difference of the maximum and the minimum generation-times difference of each output wave, and a set-period standard. In order to compare the becoming [it is stabilized most and / clear] maximum and the minimum and to distinguish an objective position, it is accurate and detect the position of the object of each detection area correctly, and. An object sensing device with high reliability which it is accurate and detects correctly the object which has each infrared detector in the duplication detection area detected mutually especially is obtained.
[0097]The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, Detect the generation times of the output wave of each infrared rays detected to this each maximum minimum, and it becomes final and conclusive, Each zero cross which the voltage of each output wave crosses at reference voltage and each is detected, When it distinguishes whether each of this detected zero cross occurred twice in one of each output wave, and between zero crosses was materialized and a discrimination condition is satisfied from this discriminated result, Since the degree of coincidence of each output wave is judged from the numerals difference of each output wave between this materialized zero cross maximum minimum and an objective position is distinguished based on this judged output, The error of the phase difference between the output waves which originate in the sensitivity differences between each infrared detector or attachment gap by the time between the zero crosses materialized in this one of each waveform is absorbed, In order to compare the maximum and the minimum which each output wave which absorbed this error is stabilized most, and becomes clear and to judge an objective position, an object sensing device with high reliability which it is accurate and detects correctly the object in each detection area and the duplication detection area which a mutual infrared detector detects especially is obtained.
[0098]The infrared rays which an object emits are detected from the detection area where a part overlaps mutually to each, Detect the generation times of the output wave of each infrared rays detected to this each maximum minimum, and it becomes final and conclusive, Each zero cross which the voltage of each output wave crosses at reference voltage and each is detected, When it

distinguishes whether each of this detected zero cross occurred twice in each of each output wave, and between zero crosses was materialized mutually and a discrimination condition is satisfied from this discriminated result, Since the degree of coincidence of each output wave is judged from the maximum and the minimum number of each output wave in the zero cross section which includes between each of this zero cross materialized mutually, and synchronous polarity and an objective position is distinguished based on this judged output, The error of the phase difference between the output waves which originate in the sensitivity differences between each infrared detector or attachment gap by the time of this zero cross section materialized mutually is absorbed, The maximum of each output wave which each output wave which absorbed this error is stabilized most, and becomes clear, the difference of very decimal **** synchronous polarity and the setting-out maximum, and the standard between waveforms of very decimal **** synchronous polarity, In order to judge an objective position [after between the zero crosses which are pauses of each output wave which shows a pause of movement of an object is materialized mutually], An object sensing device with high reliability which it is accurate and judges correctly the position of the object of two or more detection area of each is obtained.

[0099]When the maximum minimum detection means exceeds the saturation threshold width to which the pressure value of the output wave of each infrared detector was set beforehand, Since it judges that the maximum and the minimum occurred in each output wave in middle time after carrying out peak shaving of this exceeded pressure value, holding within saturation threshold width and starting this maintenance until it ends, Since the maximum and the minimum of each output wave of undetectable saturation are also detectable, an object sensing device with high reliability which it is accurate and detects the maximum minimum of each output wave certainly is obtained.

[0100]The time when the maximum minimum detection means is maintained in the minimum threshold to which the pressure value of the output wave of each infrared detector was set beforehand exceeds predetermined time, and it at the time. When the time maintained in the minimum threshold width to which it judged that detection of each output wave was completed, and the output voltage value was set beforehand is less than predetermined time, Since it judges that each output wave is continuing, minimum threshold width removes the noise of each output wave, In order to detect as the end of detection of the last Yuri return waveform of each infrared rays is become final and conclusive by predetermined time and each infrared waveform which becomes discontinuous temporarily within minimum threshold width is continued further, The incorrect judgment by a noise is prevented, detection the erroneous information which is not ended according to the last Yuri return waveform of each infrared rays is prevented, and an object sensing device with high reliability which detects each output wave in the state where it was always stabilized is obtained.

[0101]Since a waveform coincidence degree judging means judges nothing [human-body-presence] of each field based on the fuzzy rule and membership function which were set up from the peak time difference and gain between each output wave, The detection result between each output wave is complemented, in order are accurate and to judge nothing [human-body-presence] of each field correctly for the small amount of information, memory capacity is small and small size and the economical and reliable object sensing device by which the weight saving was carried out are obtained.

[0102]When a discrimination condition is satisfied by the waveform coincidence degree judging means and the maximum minimum number of each output wave in this materialized zero cross section and synchronous polarity are the same, Since the degree of coincidence of each output wave is judged based on the maximum minimum number of the last of each output wave of this zero cross section, and synchronous polarity, In order to distinguish an objective position for the maximum minimum number of each last output wave in this zero cross section, and the small detection amount of information of only synchronous polarity, early and memory capacity of processing time are small, and small size and the economical and reliable object sensing device by which the weight saving was carried out are obtained.

[0103]Since a waveform formation discriminating means avoids the end zero cross of each output wave and distinguishes each zero cross, In order to remove the erroneous information of the zero cross sheep of the Yuri return waveform generated in the last waveform of each infrared rays and to distinguish an objective position, the reliable object sensing device which prevented the erroneous information of the zero cross sheep by the last Yuri return waveform is obtained.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The outline of the block lineblock diagram of the human body detector of Example 1 of this invention.
[Drawing 2]The output wave situation map of each infrared detector of Example 1 of this invention.
[Drawing 3]The block lineblock diagram of the human body detector of Example 2 of this invention.
[Drawing 4]The mimetic diagram showing the output wave of the infrared detector of Example 2 of this invention, and the situation of waveform information measurement maintenance.
[Drawing 5]The flow chart showing the procedure of the waveform signal of Example 2 of this invention.
[Drawing 6]The mimetic diagram showing the situation of the maximum minimum detection when the output wave of the infrared detector of Example 3 of this invention is saturated.
[Drawing 7]The explanatory view of an input-and-output system of the fuzzy reasoning of Example 4 of this invention.
[Drawing 8]The fuzzy rule and membership function figure of Example 4 of this invention.
[Drawing 9]The output map figure of Example 4 of this invention.
[Drawing 10]The output wave figure of the infrared detector of Example 5 of this invention.
[Drawing 11]The output wave figure of the infrared detector of Example 6 of this invention.
[Drawing 12]The output wave figure of the infrared detector of Example 7 of this invention.
[Drawing 13]The block diagram showing the composition of the conventional human body detector.
[Drawing 14]The time chart which shows operation of the conventional human body detector.
[Description of Notations]
1 Detection area
1A and 1B Single area
1C Duplication area
2 Infrared detector
3 Amplifying means
6 Signal detection means
8 Peak voltage measurement holding mechanism
9 Peak time measurement holding mechanism
10 Waveform coincidence degree judging means
11 Detection area discriminating means
12 A/D converter
13 Time lag signal detection means
14 The maximum minimum generating detection means
15 The maximum minimum voltage measurement holding mechanism
16 The maximum minimum time measurement holding mechanism
17 The number holding mechanism of the maximum pole subtotals
18 The number means of zero cross detection meters
19 Waveform judgment condition formation discriminating means
20 Microcomputer
21 Reference voltage
22 Infrared-detector output wave
23 and 24 Signal generation detection threshold voltage
25 Signal generation time chart
26 Time lag signal generation time chart
27 Maximum

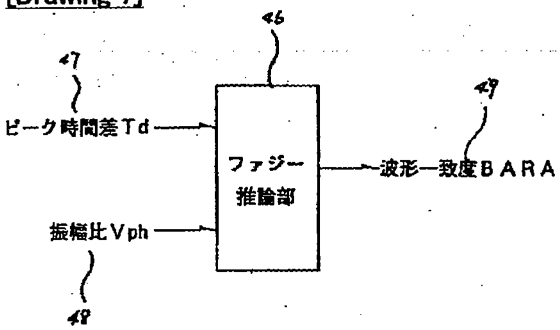
28 It is outbreak time very much.
29 Minimum
30 The minimum generation times
31 The maximum minimum detection time chart
32 Zero cross detection time chart
33 Waveform information collection processing
34 Maximum output possible voltage
35 Minimum output possible voltage
36 The maximum saturation detection threshold voltage
37 The minimum saturation detection threshold voltage
38 The maximum saturation
39 The maximum saturation start time
40 The maximum saturation finish time
41 The maximum saturation generation times
42 The minimum saturation
43 The minimum saturation start time
44 The minimum saturation finish time
45 The minimum saturation generation times
46 Fuzzy reasoning part
47 Fuzzy reasoning input : peak time difference Td
48 Fuzzy reasoning input : gain Vph
49 Fuzzy reasoning output : the degree BARA of waveform coincidence
50 Fuzzy rule
51 – 53 fuzzy membership function
54, 55 output maps
56 Boundary
57 Infrared-detector output wave
58-60 The maximum minimum (peak)
61 and 62 Zero cross
63 Infrared-detector output wave
64-65 The maximum minimum (peak)
66 and 67 Zero cross
68 The maximum minimum (peak)
69 Zero cross
70 Waveform judgment evasion period
71 Comparator
72 AND circuit
73 Decision output
F1 Signal detection processing
F2 Branching by signal detection
F3 The maximum minimum detection processing
F4 Branching by the maximum minimum detection
F5 The maximum minimum voltage measurement holding processing
F6 The maximum minimum time measurement holding processing
F7 The number holding processing of the maximum pole subtotals
F8 Zero cross detection processing
F9 Branching by zero cross detection
F10 zero cross — calculation — holding processing
F11 Criteria branching process
F12 Peak coincidence degree decision processing
F13 detection-area discrimination processing

[Translation done.]

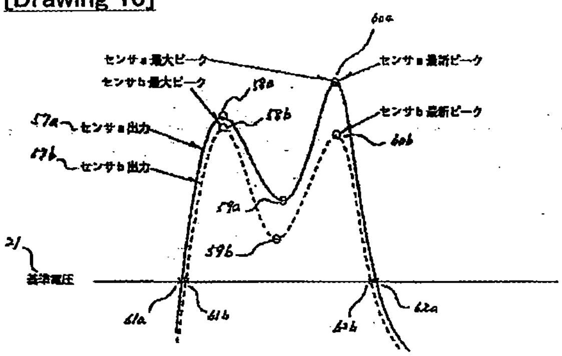
* NOTICES *

DRAWINGS

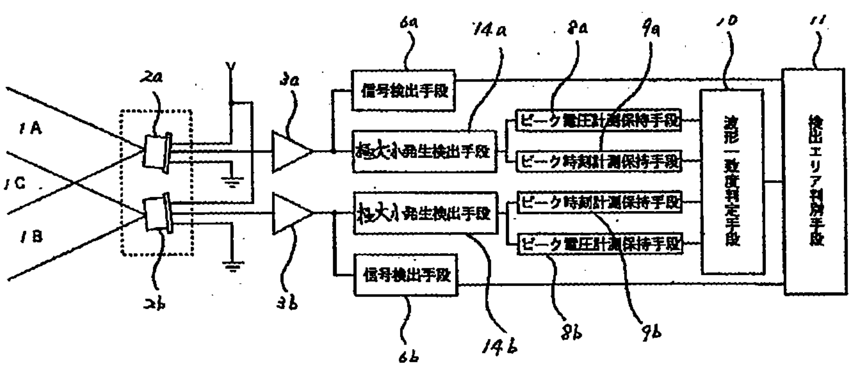
[Drawing 7]



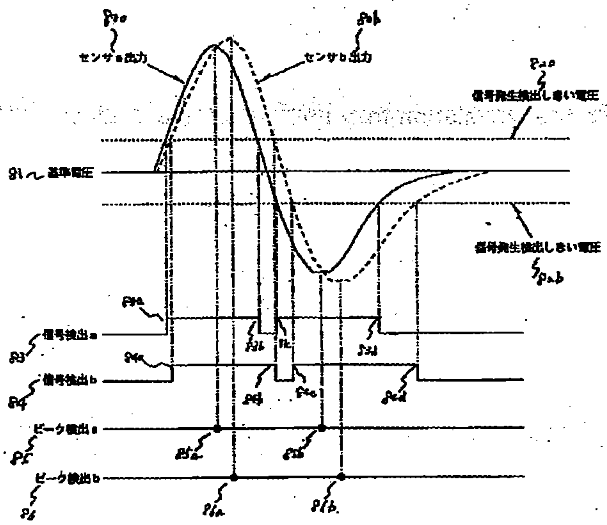
[Drawing 10]



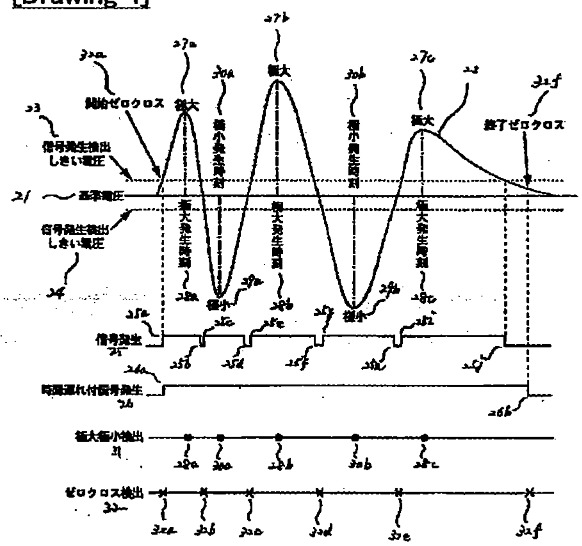
[Drawing 1]



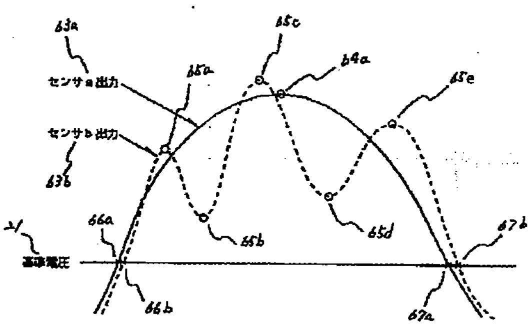
[Drawing 2]



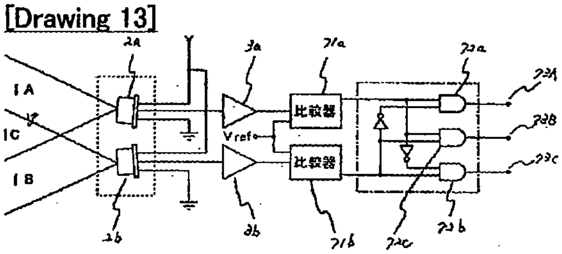
[Drawing 4]



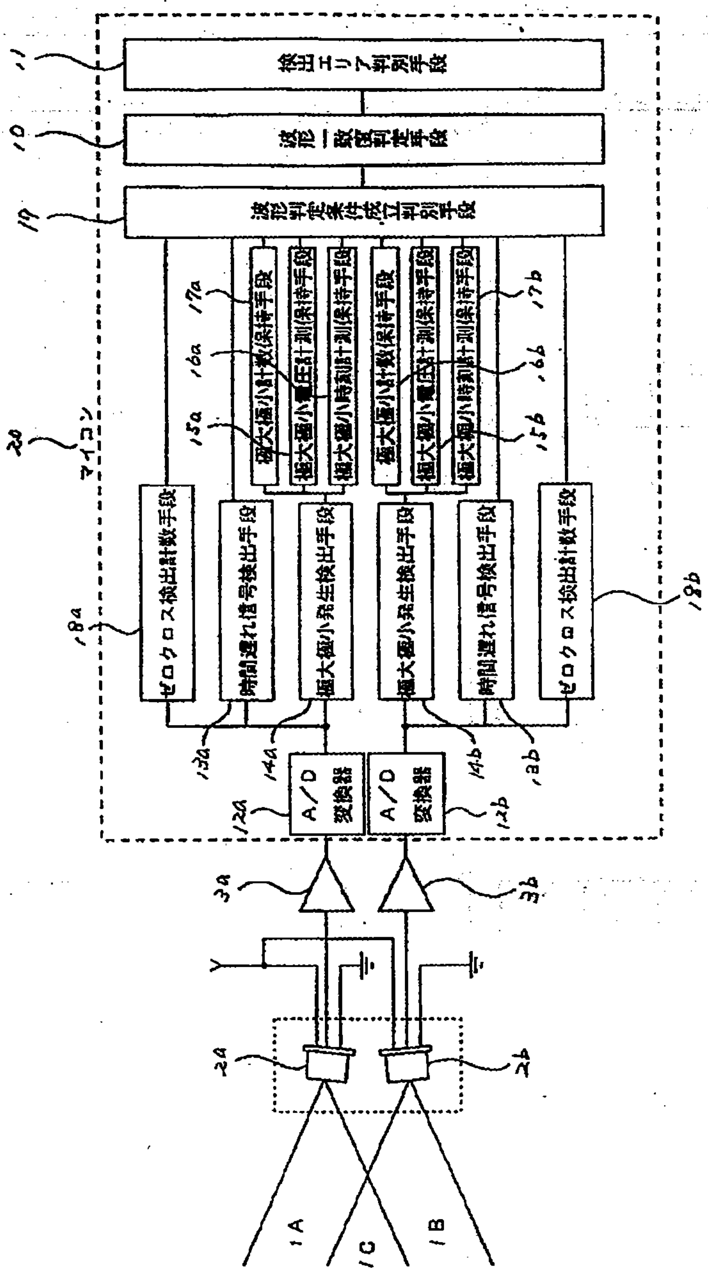
[Drawing 11]



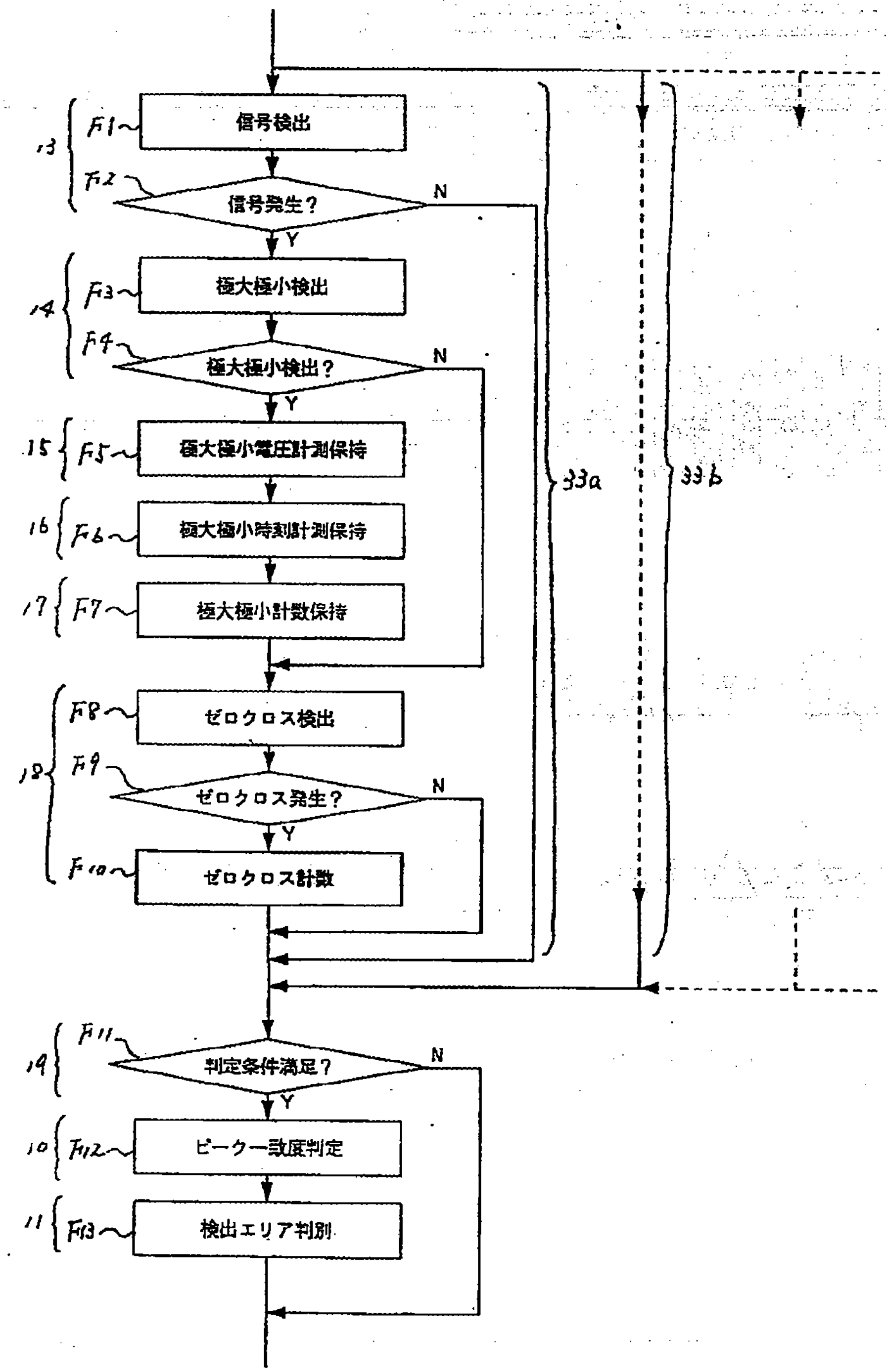
[Drawing 13]



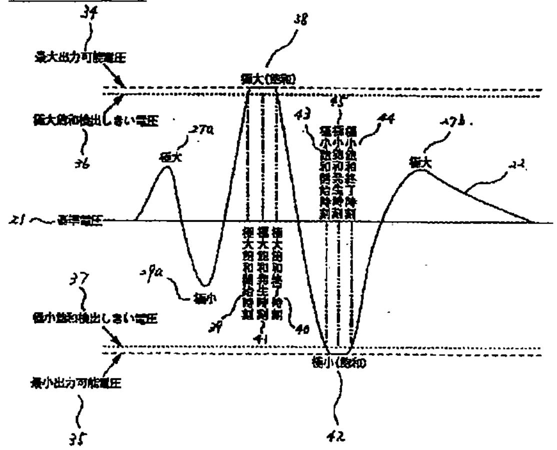
[Drawing 3]


検出エリア判別手段
波形一致度判定手段
波形判定条件成立判別手段
極大極小計数保持手段
極大極小電圧計測保持手段
極大極小時刻計測保持手段
マイコン
ゼロクロス検出計数手段
時間遅れ信号検出手段
極大極小発生検出手段
A/D 変換器
1A
1C
1B

[Drawing 5]


F1
信号検出
F2
信号発生？
N
Y
13
F3
極大極小検出
F4
極大極小検出？
N
Y
14
15
F5
極大極小電圧計測保持
16
F6
極大極小時刻計測保持
17
F7
極大極小計数保持
F8
ゼロクロス検出
F9
ゼロクロス発生？
N
Y
F10
ゼロクロス計数
18
33a
33b
F11
判定条件満足？
N
Y
19
10
F12
ピーク一致度判定
11
F13
検出エリア判別

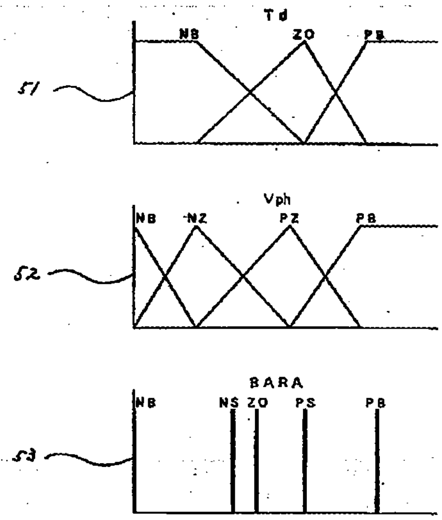
[Drawing 6]


34
最大出力可能電圧
38
極大(飽和)
極大飽和検出しきい電圧
36
27a
極大
43
45
44
27b
極大
22
21
基準電圧
極小飽和開始時刻
極小飽和発生時刻
極小飽和終了時刻
極大飽和開始時刻
極大飽和発生時刻
極大飽和終了時刻
37
29a
極小
極小飽和検出しきい電圧
39
41
40
極小(飽和)
最小出力可能電圧
35
42

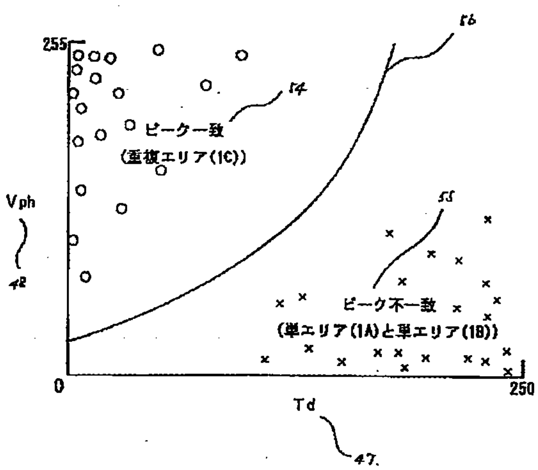
[Drawing 8]

50

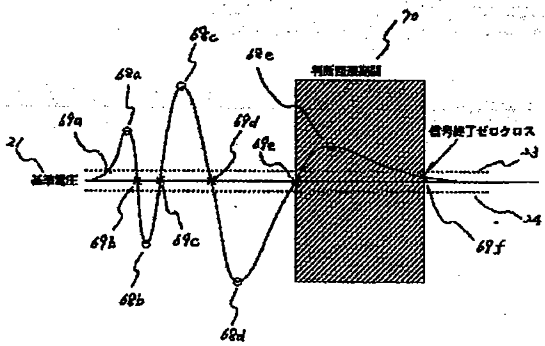
		Td		
		NB	ZO	PB
Vph	NB	NS	NB	NB
	NZ	PS	NS	NB
	PZ	PB	NS	NB
	PB	PB	ZO	NB



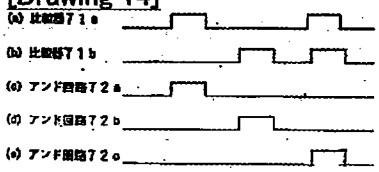
[Drawing 9]



[Drawing 12]



[Drawing 14]



[Translation done.]